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Tenth Avenue at 36th Street,
NEW YORK, N. Y.
Cable Address "Machinist, N. Y."

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Publishers of
Electrical World
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Radio Retailing
Engineering News-Record
Electric Railway Journal
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Aviation
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(*Published in San Francisco*)
American Machinist—European Edition
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SUBSCRIPTION PRICES: United States and its possessions, Canada, Mexico, and other countries taking domestic postage rates, $5 a year. All other foreign countries, $9 a year. Single copy, 25 cents. Published weekly. Entered as second class matter, Jan. 20, 1907, at the Post Office, New York, N. Y., under the act of March 3, 1879. Printed in U. S. A.

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Member Audit Bureau of Circulations.
Member Associated Business Papers.

Circulation of this issue, 18,900

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The consolidation of Electrical world, Electrical Engineer and American Electrician

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Volume 93 — *New York, Saturday, June 15, 1929* — Number 24

An Industry Leader Becomes an International Benefactor

AFTER an absence of many months in Europe Owen D. Young has again returned to the bosom of the American electrical industry. While abroad he devoted himself unstintingly and unsparingly, as the chairman of the reparations commission, to fixing the total amount of German reparations. That work called for all the patience, diplomacy and finesse at his command, and no one probably felt greater joy and relief on the successful termination of the mission than Mr. Young himself. His country has reason to be proud of Mr. Young's added achievements in the cause of international amity and good will, and the electrical industry, which has always held him in the highest esteem and admired his many superior qualities of mind and heart, is particularly gratified with his success and happy in his return. At an opportune time it will demonstrate its pride in and affection for its illustrious son.

* * * *

Silence Is Not Always Golden

SIR ERNEST BENN'S concise and forceful "movietone" address, delivered at the Atlantic City convention of the National Electric Light Association last week, was a notable contribution to the literature on private ownership. The novelty of its presentation and the faithfulness with which Sir Ernest's voice and manner were reproduced in the great auditorium, while excellent and arresting, were eclipsed by the substance and clarity of his argument. It was generally conceded to have been one of the most convincing talks on the merits of private ownership ever heard in this country, and its brevity gave it added strength.

This brings the whole question of private ownership propaganda again to the front. Shall the electric light and power industry prejudice its cause by a fallacious attitude of silence born of timidity? Those who believe in government ownership seek at all times and in all places to spread their gospel, and the little that their opponents do cannot by any stretch of the imagination be termed adequate counter-propaganda. And yet, if the seemingly plausible but false and socialistic doctrine is not to overrun the country and convert many who refuse to think the thing out, it is necessary that those who believe the existing economic system of private ownership is adjustable and elastic enough to serve the needs of the present and of the future should manifest as much courage to voice their convictions as do their opponents.

Too much is taken for granted. Reports, distorted by government ownership zealots, emanate from Washington and are spread broadcast by the press of the country. In one week there is more said against the industry than it can refute in a year. This should not be. Silence is not golden under such circumstances. Believers in private ownership are not bound to sacrifice lifelong convictions. There is no overruling power that can make them stultify themselves and throw away all the proved advantages of individual initiative and enterprise. If they submit to these things, it is because they do not wish to do otherwise or fear to vindicate their human competency. Given more men of Sir Ernest Benn's conviction and fearlessness, the industry would soon silence its calumniators, and facts long smothered by fiction would once more triumph over it.

* * * *

Promotional Rates for Marginal Power Users

WIDESPREAD adoption of purchased power by industrial plants during the past ten years has led many utility company managers to believe that they have done a real job and have obtained "all the business to which they are entitled." So long as any local industry is obliged to supply its own electrical power the local central station has failed in its full duty. The central station should supply *all* the electrical energy requirements of its community. It should supply all these electrical loads at a profit, but that profit need not be a constant percentage.

The rate charged for a service should bear just as much relation to its value to the particular user as to the costs of the producer. Rates for lighting are higher than for power, not alone because of greater expense to the producer, but because of greater value to the user of light than to the user of power. It is not unusual to find a large commercial lighting load having greater consumption and higher load factor than many power loads but paying a higher rate.

If electrical energy has greater value in one form or class of service than in another, it is also true that it has more value for some power users than for others. Consider the industrial customer using large amounts of process steam. On the cost-to-serve theory of rates, the utility would charge this customer the same rate as any other customer having an equivalent electrical load. In most cases such a rate would induce a prospective consumer to buy power, but it might well be higher than the electrical production costs of the user of process steam. Yet the utility might be able to sell the electrical energy to the user of process steam at a rate below the customer's cost and still above the utility's cost of production, plus reasonable charges for facilities devoted to the customer's service. The utility would be satisfied with less than the average spread between theoretical cost and price, but it would make money, the customer would save money and the community would benefit.

This problem is far from being an academic one. Every week sees development of plans for huge generating stations by industrial concerns that are large users of process steam or have other means of producing cheap power. Plants of 10,000 kw. and even 50,000 kw. are being erected under the noses of utility companies' "superpower" stations. The addition of these huge industrial loads to the lines even of large utilities would effect startling economies. In some cases the load factors of these industrial loads are higher than those of most central stations. Some have load factors and power factors in excess of 90 per cent.

The next development after the installation of large generating plants by industrial users is to interconnect those plants in a given area where all the well-known advantages of interconnection can be secured. From this have grown potential consolidations representing more than 50 per cent of the industrial load of the local utility. This is not sound economics. It is not good business. It is evidence of inadequate community service by the utility. It is a condition which, allowed to develop, will seriously threaten the position of those utilities that depend largely upon power business for their load and for their earnings.

More freedom should be allowed utility managements to accept this marginal-cost business without criticism. Already several commissions have approved contracts with large users whose loads could not have been obtained at established rates for average users, but which can be served with some profit and no burden on other customers.

* * * *

Utilizing Standards of Subsidiary Companies

EVEN when progressively managed companies are acquired by centralized organizations, some changes in routine must be expected if advantage is to be taken of unifying engineering, accounting and sales practices. But frequently excellent local standards of practice have been built up that deserve wider application. It becomes, therefore, very desirable that a thorough study of the established procedure in acquired properties be made before articulating them into the larger system. It is a poor rule that does not work both ways, as the old adage has it.

Sometimes there is a temptation to stop the preparation of standards on a local property as soon as it passes under centralized control. This is not surprising in the press of activities attending a transfer of a company from one control to another, but it is important not to allow good standardization work that has in the past been done by a newly acquired property to drop out of sight. For example, a company may have prepared a series of operating, maintenance and construction standards representing years of development with special application to its own conditions. The incoming central organization should make an early study of such material in order that its preparation may continue, if advisable, without loss of time to the local property, and so that any ideas or methods of wider application may be put into general service throughout other affiliated properties as soon as convenient.

The main point, whether in accounting, construction or other fields, is not to allow the fruits of original creative work to fail to ripen for lack of executive nourishment or to lie on the ground unharvested on account of change of ownership or management.

Sensible Co-operation in Power Development

SEVERAL instances of co-operation between irrigation districts and power companies in the development of water and power are on record, notably in California, but the recent announcement that a steam plant will be erected in Phoenix to serve the joint needs of the Salt River Valley Water Users' Association and the Central Arizona Light & Power Company is unique.

The Salt River Valley Water Users' Association is a landowners' organization deriving water from Roosevelt Dam and power from several hydro-electric plants on the Salt River. It is composed of and owned by the farmers served and is operated identically like a private corporation, with the exception that the president is elected by popular vote of the association members instead of by a board of directors. The Central Arizona Light & Power Company is a privately owned and operated electric utility serving Phoenix and a small surrounding territory.

The ninth consecutive year of drought finds the Water Users in need of power to meet their own needs and fulfill contracts. The private company has in sight by generation or purchase power enough for its own needs for a period of three years, after which it will require additional steam capacity. A happy solution to the whole situation was arrived at by an agreement under which the private company will finance and build an 18,000-kw. steam plant in Phoenix immediately. The Water Users will pay all fixed charges and operating costs of the plant for two years and derive all the plant output. For the next three years the ratio of expense and output will be two-thirds and one-third then for three years one-third and two-thirds, and after eight years the private company will take over the entire expense and receive all the output.

The Water Users and the private company have clearly defined the territory each will serve to avoid destructive competition, and with the agreement just entered into the whole set-up constitutes one of the finest examples of sensible co-operation in power development on record.

* * * *

Two-Story Turbines Enter the Field

MANUFACTURE by the Brown Boveri organization of the first 160,000-kw. turbo-generator for the Hell Gate station of the United Electric Light & Power Company was a notable effort in the direction of saving space and reducing floor-area requirements in generating stations. The installation of the great turbo-generator in the space originally allowed for a far smaller unit was an engineering achievement. Formal ceremonies at the station recently marked the initial operation of this unit and of the more recent Westinghouse machine of similar capacity. There are, of course, a number of other directions in which savings involving capital charges may be made and similar economies produced. Water-cooled furnace walls have so greatly increased the space efficiency of furnaces that tremendous capital investment for land, superstructures and equipment has been largely avoided.

The announcement of a two-deck 1,200-pound turbo-generator of 100,000 kw. normal rating for the Pacific Gas & Electric Company introduced another interesting departure in such developments. It is undoubtedly possible to place the high-pressure element on top of

the low-pressure element, thus saving foundation and floor areas through the introduction of real compactness; but the conservative engineer has a few mental reservations.

The advantages of two-deck design are readily discernible, but the undeniable decrease in accessibility and possibly reduced ease of repairs and maintenance must be balanced against the capital savings involved. As the reliability of mechanical equipment is reflected in the fewer hours during which it is out of service for repairs and inspection, it becomes increasingly possible to take advantage of the longer service expectance of equipment and to adopt such an expedient as has been planned for the progressive California utility.

* * * *

Cable Experts Disagree

FOR some time now it has been recognized as a fundamental principle of high-voltage cable construction that every measure must be taken to avoid the occurrence of air or gaseous spaces within the mass of the insulation. Such gas spaces may be the result of originally imperfect impregnation, in which case the result is a rising power-factor voltage curve and shortened life. It has also been generally supposed that in operation such air spaces can arise between the outer wall of the insulation and the lead sheath. This, it is thought, is due to the relatively greater coefficient of expansion of the insulating material, the stretching of the lead and the failure of the lead to return to its original dimensions when the temperature is reduced.

This idea has been widely accepted, but is disputed by C. J. Beaver, a well-known English engineer and author, in a series of articles published in the London *Electrical Review*. He presents a number of experimental results which indicate that the internal pressures due to temperature rise within the cable are not sufficient to cause an appreciable expansion of the lead sheath. His experiments show a rather wide range of pressure variation with inappreciable changes in sheath volume. The voids often found in defective cables he attributes to air originally entrained, or in solution, in paper or compound, supplemented by gases later generated. Exception is taken to Beaver's attitude by Riley and Scott, equally well known as cable engineers. They review much evidence which has been adduced in support of the idea of the expansion of the lead sheath and reach the conclusion that Beaver's results are due to occluded air in his experimental cable. Naturally, Mr. Beaver has made a spirited reply, and doubtless the discussion will continue.

There is general acceptance in this country of the idea of sheath expansion with resulting voids. Measurements made by Hirshfeld and his co-workers of the Detroit Edison Company have shown not only the presence of very high internal pressures, but also that a permanent expansion of the lead sheath to the extent of several per cent is clearly possible. Less importance has been attached to the matter since the introduction of the "type H" cable, which provides an inside metallic sheath for the wall of the insulation and which follows the expansion and contraction of the latter very much more closely than can the lead, thus eliminating the danger of ionization in any gas layer arising between insulation and sheath. In the discussion referred to, as often happens, strong evidence can be produced on both sides It seems to be clear, however, that Mr. Beaver has made the closer experimental study of this matter and has shown that a considerable range of pressure may occur in a cable without undue expansion of the sheath.

* * * *

Interconnection Economies Demand Constant Vigilance

INTERCONNECTIONS will not run themselves. Automatic frequency control, modern waterwheel governing and the paralleling of high-grade plants may attain a routine status under a carefully organized régime. Continuity of service records may display praiseworthy performance. But if money is to be made on top of all costs in this interesting and expanding field, acute watchfulness must prevail. The larger the interconnected system, the greater the vigilance which needs to be maintained over load allocations, up-to-the-hour operating costs and total expenses concerned with interchange.

The casual handling of early tie-line practice, which gave good results in smaller fields and even in sub-regional power distribution, has little place in current large-scale interconnection. No one is likely to dispute the importance of constant scrutiny of interconnection operations from the load dispatcher's point of view, but unless one has access to the actual ebb and flow of costs concerned in this work, it is easy to overlook the changes in economic values to which a multi-party power interchange group is often subject. Executive engineering direction becomes vital as the scope of interconnected operations broadens.

Surprising variations in unit values employed in interconnection activities occur from time to time. Average prices paid per kilowatt-hour for secondary hydro-electric power fed into a well-run interchange transmission network, for example, ranged in a recent month from less than 0.1 mill to more than 4 mills among about half a dozen participants. The selling prices to members of the group ranged from nearly half a cent to, roughly, 9 mills. These averages varied considerably among the group members and for individual participating companies when other periods were summarized, and they were materially influenced by the hour-to-hour costs prevailing on the various properties. The time value of a given block of available energy, whether in steam or hydro plants, with respect to current loads and their distribution over the system had a most important bearing upon costs and savings realized. The ratio of total expense of interconnection to total revenue derived from the sale of pooled power varied from 63 to 80 per cent between a recent month and a recent four months' operations. In one of these four months the savings from interconnection, after all costs were deducted, amounted to nearly 40 per cent of the total period's economies.

The importance of building up loads to fill valleys in the total and component company demand curves literally stares the operating engineer and executive in the face as such records are studied in detail. The challenge is twofold: (1) to utilize the maximum available skill in economical over-all system operation on the basis of accurate and instant knowledge of conditions at all times prevailing, and (2) to create from alert analysis of interconnection and grouped property performance a vision of load building and system planning which shall key the combined resources of electrical production and supply to "concert pitch" in economic efficiency.

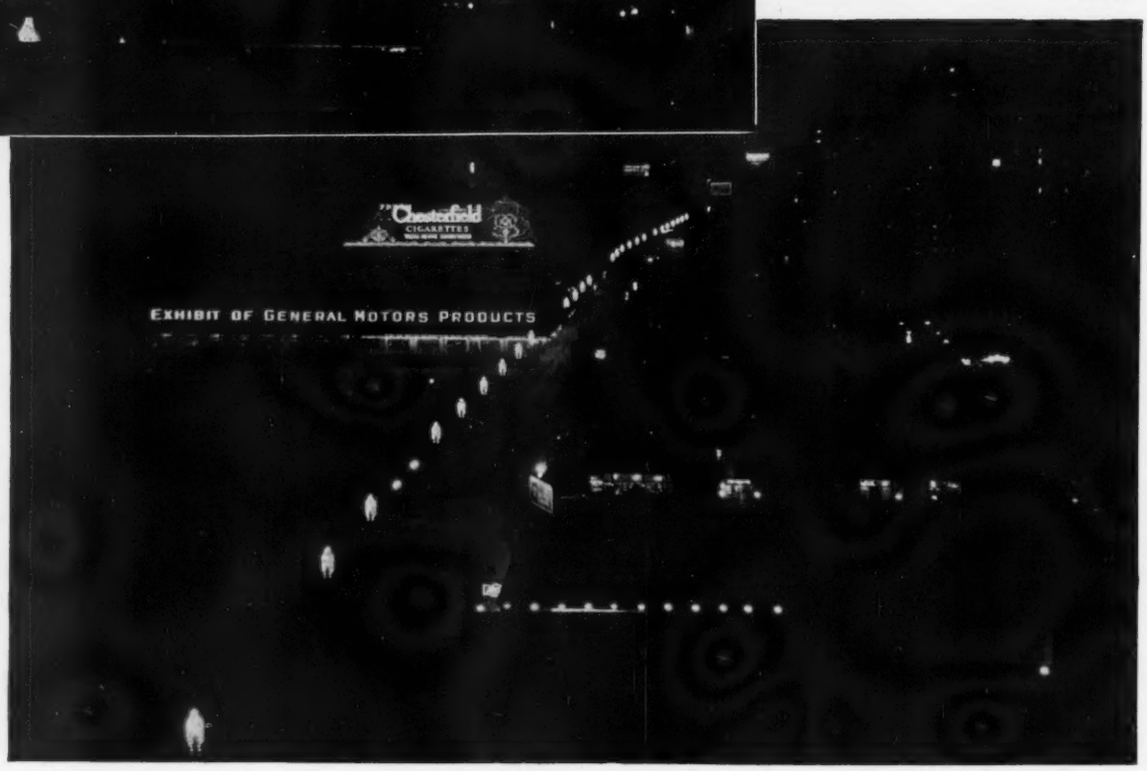
Jubilee Effects Along the Boardwalk

Courtesy W. D'Arcy Ryan, General Electric Company

Golden showers replace globes formerly illuminating boardwalk

Gorgeous illuminated fountain that automatically passes through many water and lighting cycles

Boardwalk lighting after 1 a.m.



Courtesy A. L. Powell, Edison Lamp Works

Station Tie Is Backbone of

Chicago's 60-Cycle Layout

Fundamental considerations that have determined design of transmission substations and stations. Double bus system and frequent sectionalizing prevent large concentrations of short-circuit power and permit indefinite expansion

By R. F. SCHUCHARDT and T. G. LE CLAIR
Chief Electrical Engineer and Assistant Engineer, Respectively, Commonwealth Edison Company, Chicago, Ill.

LARGE transmission systems, and particularly the parts of them devoted to interconnections between generating stations, have several major purposes. They are increased over-all economy, reduction of the reserve capacity required and improved reliability. Increased economy results from carrying a maximum of load for long hours on the most efficient units of the system. The extension of the area served also results in a better load factor for the system. Improved plant efficiency and decreased reserve capacity are due to the use of fewer and larger machines in a given area and the availability of common reserve over the system.

The gain in reliability does not come about quite so readily as does the gain in economy. The fact that a given load may be fed from more than one source of supply through a transmission system does not necessarily mean any less likelihood of service interruption. Unless adequate provision is made for the disconnection of faulty equipment, each additional transmission line becomes an additional hazard. When generating stations were tied together through transmission lines to the same substations, and as the number of these transmission lines increased with the increase in capacity, the network became so complicated that relay protection was very difficult to co-ordinate and the shock due to a short circuit was communicated to all parts of the system.

To correct this, the earlier transmission scheme in Chicago was changed by eliminating the lines which thus indirectly connected generating stations. Direct ties between stations at generator voltage were later replaced by larger capacity ties at higher voltage. The original higher voltage lines were operated at 33 kv.

Further development of these interconnections has resulted in a 66-kv. overlying bus system connecting the major load centers, which supersedes the 33-kv. system. The much larger capacity of this overlying system has made possible the establishment of load centers, called distributing stations, which lie midway between generating stations. They are without generating capacity and are fed from the 66-kv. system only. These distributing stations give service which is equal in reliability to that direct from the generating stations.

As the size of generating stations increases, or the amount of load to be distributed from any given center increases, the extent to which possible trouble may spread also is greater. This has given rise to a number of schemes of subdivision which are applied to stations or

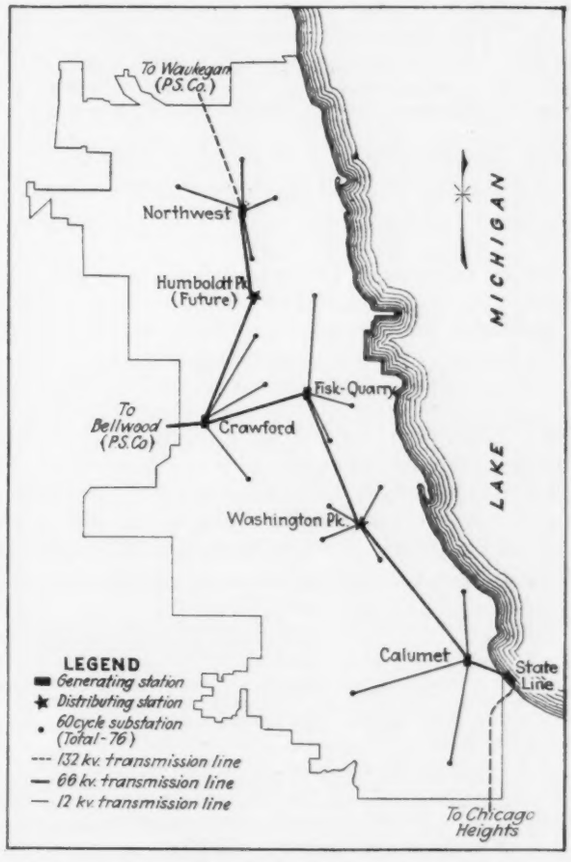


Fig. 1—Position of Generating Stations and Bulk-Supply Substations in Chicago

Distribution substations are fed from single points only, their only ties being thorough the 66-kv. system.

to systems as a whole. A good example of such a plan is that called "loose-linking." The practical design for any large system is a compromise between economy and reliability. From the standpoint of economy it is desirable to concentrate the capacity in order to utilize diversity and decrease the required reserve. From the reliability angle it is advisable to break up the system into smaller sections to minimize the extent of possible interruption. Good judgment dictates the point of compromise between the two ideals.

In the Chicago system the plan is to sectionalize the generating and distributing centers along lines ranging between two limits, the extent to which the subdivision is carried out depending upon the capacity involved. One type of sectionalizing may readily be changed to another as the capacity increases. In all stations there are two main buses, which are more or less independent and are

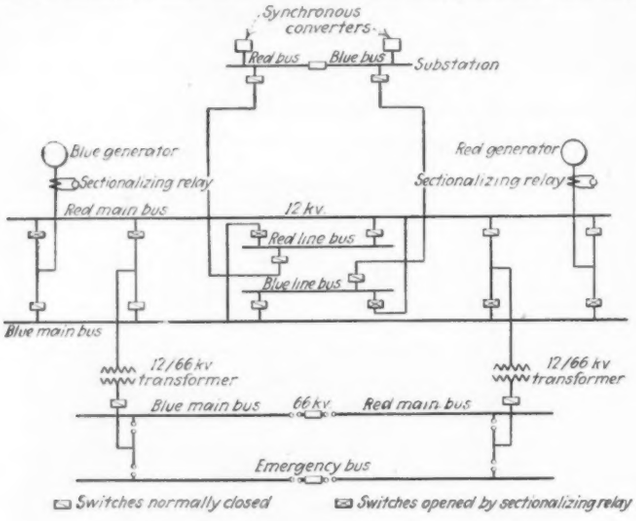


Fig. 2—Method of Sectionalizing Where Concentration of Energy Is Not Great

Used in the lower capacity centers where reactors are not required between sections for normal operation.

arbitrarily designated the red and blue. They establish the nucleii for the red and the blue systems, which are carefully maintained throughout the transmission system with all methods of sectionalizing.

For the smaller stations, where the capacity available to flow into a short circuit is relatively small; that is, on the order of 150,000 to 200,000 kw. in generators, transformers or both, the scheme shown in Fig. 2 is adopted. Outgoing transmission lines to substations at 12,000 volts are not connected directly to the main buses, but in small groups to line buses, which in turn are fed from the two main buses. Under normal conditions the line buses and the supply units, either generators or transformers, are connected to both main buses. The supply units are equipped with overload relays, which will operate in case of a severe disturbance, not to interrupt the supply, but to open half the circuit breakers and leave the station operating in two separate systems, with equal division of line buses and units, so that the disturbance will be confined to only one-half. The opening of all these breakers is accomplished by the same relay and this operation will take place very quickly in case the disturbance is severe enough to warrant the division of the capacity and of the load.

In that part of the city which is supplied by the direct-current network every 60-cycle substation is equipped with two high-tension buses, one of which is fed by lines normally connected to the blue system and the other by lines normally connected to the red system. The direct-current network is also supplied by 25-cycle substations interspersed with the 60-cycle. An unforeseen emergency which would cause the interruption of half the 60-cycle supply to this territory (red or blue system) would interrupt the supply to half the converting capacity in each substation. A part of the load would be picked up by adjacent 25-cycle substations and the remainder by the live capacity in the 60-cycle substations without interruption to the network. If the disturbance is not cleared promptly, or in case the red or the blue bus system is crippled, the substation can be restored to full operation by opening the line breakers on the crippled section and closing the bus tie circuit breaker. The good generating capacity in the station can be then thrown over to the system which is unaffected and practically complete service restored.

The foregoing method of sectionalizing will not be satisfactory for much larger stations because of the concentration of available short-circuit energy. Under such conditions the plan illustrated in Fig. 3 is employed. It can be used for a center of infinite capacity by increasing the number of sections and the number of reactors at division points. This scheme differs from the one just described in that the red and blue main buses are

Fundamental Principles Involved

1. The Chicago layout contemplates an indefinite expansion of generating capacity, an indefinite location of distributing station points and a continuous increase in load density.
2. Excluding zone loads in the vicinity of Chicago generating stations their outputs are taken away at transmission voltage. Except at this pressure there are no ties between substations or power stations.
3. In effect, the transmission lines constitute a bus overlying the system—a bus into which power houses feed at various points and from which bulk-supply substations take their supply at the same and other points.
4. The distribution substations are not fed directly from the transmission system but through bulk-supply distributing stations which step down the transmitted energy to the distribution-substation supply pressure.
5. All distribution substations are radially fed, either from the power stations or from the bulk-supply substations.
6. Short-circuit currents are kept to a minimum phase by isolation, splitting the transmission bus into two parts and also by generous sectionalizing of the parts. Combined with the use of neutral resistors phase isolation reduces the short-circuit current to reasonably low values.
7. The fault-bus system of protection is used with nearly all isolated-phase bus structures whether in open air, metal clad, or in masonry or steel cells. If a fault occurs on any part of the system that part automatically drops out, but its service is immediately taken over by the rest of the system.
8. The scheme is so arranged that a fault may put out of service only that part which is immediately affected by it. A fault does not dangerously disturb the functioning of the system as a whole.
9. At all generating stations or transmission terminals incoming and outgoing transmission lines terminate in buses at the line voltage.
10. All buses, at points where there is a large concentration of power, are capable of operation in sections in such a way as to minimize the effect of severe or prolonged short circuits.
11. Lines to a dependent substation or to a group of substations are so disposed at the generating station or distribution center as to reduce to a minimum the probability of a total interruption to the substation resulting from the loss of one unit of a station bus.
12. These schemes have permitted a reduction in the minimum time element of protective relays. Balanced relays are used in all cases where practicable.

normally connected together through reactor ties, not directly as is the case in the simpler scheme. Each supply unit and each line bus is provided with switching equipment to connect to both main buses, but is normally connected to only one. The required reserve capacity is obtained, since each section has a supply normally from the connected generator capacity, but in case this capacity is out of service the section is supplied through the reactors at both ends.

The reactors between the red and blue systems have a relatively high ohmic value so that a dead short circuit on one system will not cause a severe drop in voltage on the other system. The amount of current which will flow through a bus tie reactor under normal conditions is only sufficient to take care of the slight unbalance which normally occurs between the loading on the red and the blue buses. The reactors between sections of each main bus are of a lower ohmic value, which is sufficient only to limit the short-circuit current and will allow the passage of a very considerable load current when generators are out of service or operating at different loads.

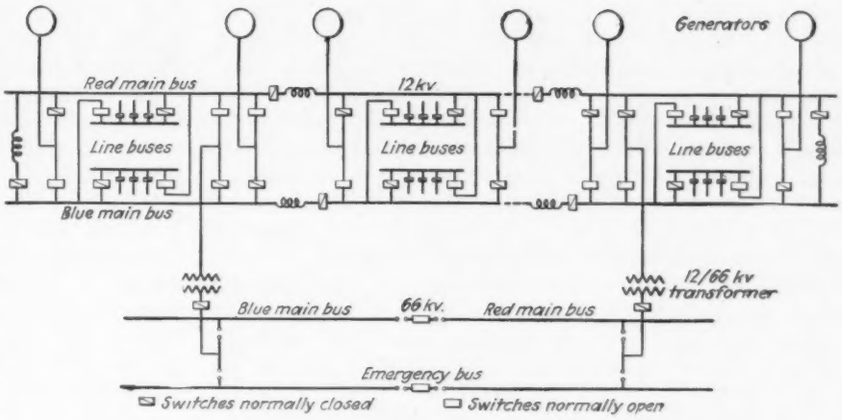


Fig. 3—Sectionalization of a Large Station

The two bus systems are normally connected together through high-reactance ties. The number of reactors in either main bus depends upon the size of the station, which can be increased indefinitely without adding materially to the danger of complete shutdown or to the short-circuit current.

The transition between the first type of sectionalizing and the ultimate type is accomplished by installing reactors between sections of the main buses as they are being extended and by installing the reactors between the two main buses at each end of that portion of the switch house which is complete. An intermediate step may also be to omit the reactors between sections of each bus and install only those between the two main buses. This method is used in Calumet station.

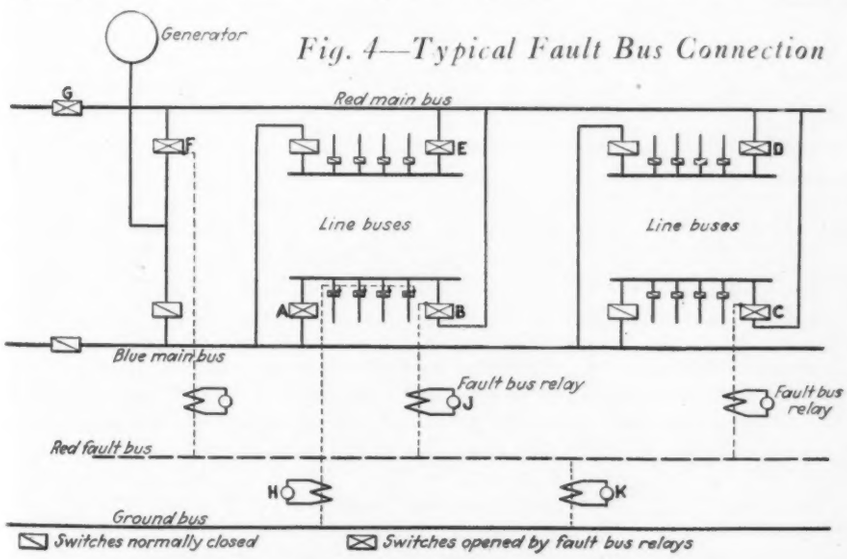
The Fault Bus Is Important

The problem of sectionalizing in the generating stations is somewhat complicated by the method of bus protection used in the newer design of switch house. With the isolated phase structure which is now used in Chicago at all points where there is any concentration of capacity, faults are limited to one phase to ground. The current which can flow through these short circuits is then limited by the use of neutral resistors. The fact that all faults can be only to ground is taken advantage of in the protection system, which by the use of a fault bus actually picks up the fault current and conducts it back to the neutral through the proper relays. This is accomplished by having no regular ground bus in the switch compartment and using in its place an insulated conductor which runs through the various switch compartments and is connected to the frames of circuit breakers, etc.

The manner in which this protection is applied is shown by Fig. 4. On this diagram one of the light dash lines represents a branch of the fault bus which is connected to the frames of all the circuit breakers on one of the line buses and passes through the line bus compartment. If a ground occurs on the equipment about this line bus the fault current must pass through this fault bus to the station ground bus. In so doing it operates the overload relay shown at point *H*, which, in turn, opens the four line circuit breakers and the two group breakers *A* and *B*, clearing the fault.

A different condition arises with a failure on the group switch breaker or its appurtenances. The branch of the fault bus in this compartment conducts the current, not directly to the main ground bus, but to a separate fault bus which picks up the branches from all the group switch breakers on the same section of the main bus. This fault bus in turn is connected to the ground bus through an additional relay. In case of a failure on breaker *B* the current actuates the overload relay at *J*, which opens the same breakers as were opened by the relay at *H*. If the fault chances to be on the side of the breaker toward the line bus, this clears the trouble and nothing further happens. If, on the other hand, the fault is on the side of the breaker toward the main bus, the fault current continues to flow until the relay at *K*, which is set for a longer time delay, will operate and open breakers *C*, *D*, *E*, *F* and *G*.

Fig. 4—Typical Fault Bus Connection



This shows the fault bus arrangement for one line bus and a part of the fault bus connections for one section of main bus. Corresponding connections are made throughout.

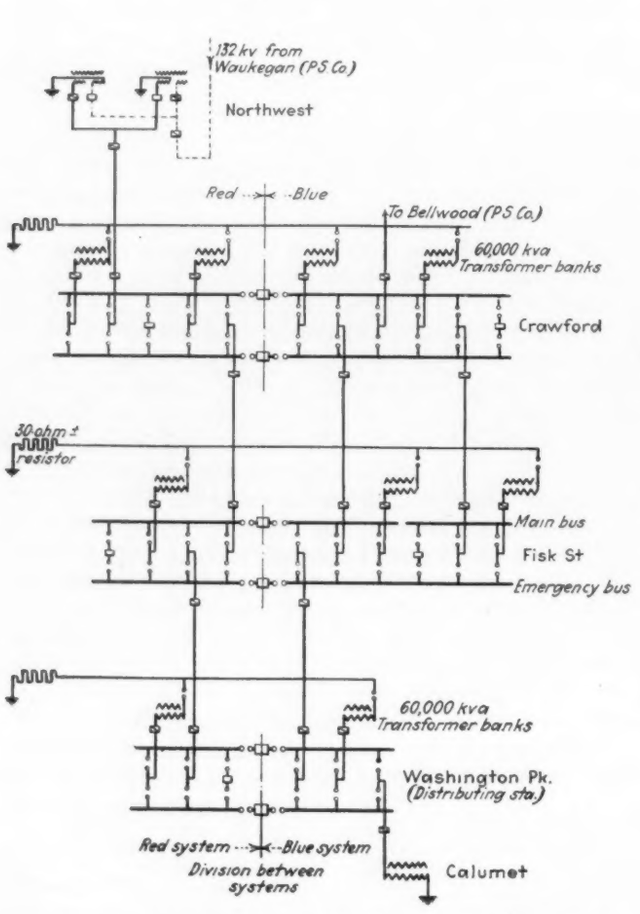
In case the type of sectionalizing used is that shown in Fig. 2, where the group switch breakers are normally closed to both main buses, this operation will not interrupt the supply to any lines excepting those on the line bus which is involved in the fault. In the case of the larger stations, where the supply is connected to only one main bus, the supply and the line buses connected to this section of the main bus will be interrupted by a fault bus operation, but because of the large number of sections and the fact that lines to groups of substations are staggered between sections, this will not cause interruption of service to any load.

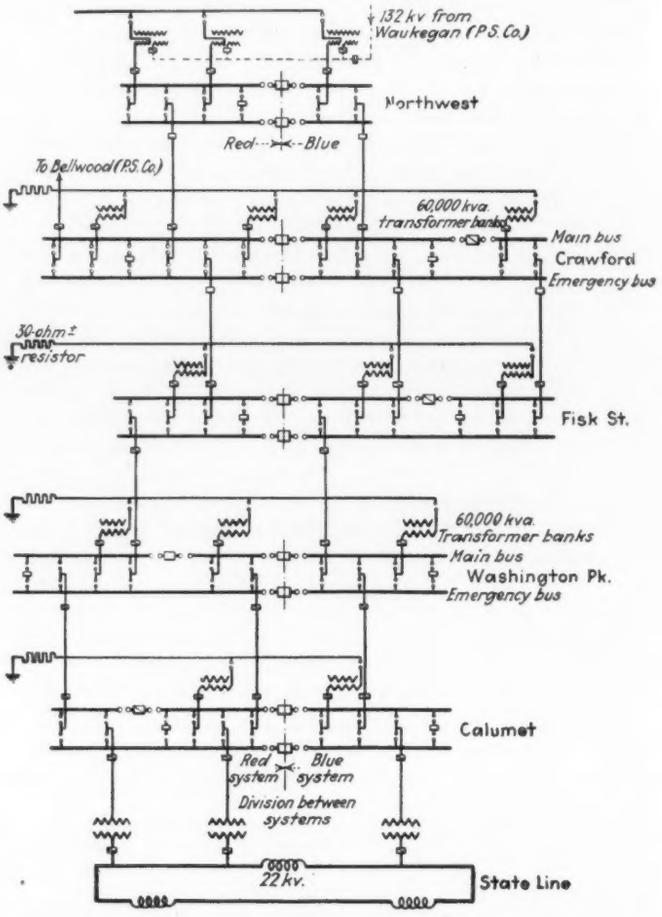
Since the fault bus was installed, about one year ago, there have been six operations, each of which performed in the exact manner for which the system was designed and none of which interrupted any load. In fact, some cases of trouble were cleared so quickly and the damage done was so slight that it was difficult to discover the point of failure. To insure correct operation of the fault bus, all branches are carefully checked for insulation resistance before being placed in service.

On a large metropolitan system the problem of interconnection between stations is one of transmitting large blocks of power over comparatively short distances. Where there are several generating stations in a small area, such as in Chicago, the addition of large units materially changes, and even reverses, the direction of power flow under different conditions. The system must, therefore, be more flexible than one of the direct transmission type where the energy flows from one generating station to a given load and practically all the energy is transmitted over some distance.

This requirement of flexibility makes a bus system desirable for the interstation high-voltage tie lines for operating reasons. It is also more economical, since by the use of this bus system the number of transformers required at any center is dependent upon the amount of load to be taken into or out of this center and not upon the number of lines entering it or leaving it. This is particularly desirable when the interconnected lines carry an appreciable quantity of energy which passes by a given center to some point beyond. The effectiveness of the bus system in reducing transformer capacity can be observed in Figs. 4 and 5 a, which indicate considerably fewer transformers than would be the case with the conventional two transformers per line.

Another advantage of the bus system which applies particularly when energy is to pass beyond one station to another is the independence of the high-voltage and low-voltage systems. This means that in any generating





Figs. 5 a and b—The 66-Kv. System During the 1928 Peak and as Planned for the 1929 Peak

(a) Each transmission line has a capacity of 60,000 kva. in the winter time and each transformer bank has a capacity of 60,000 kva. Neutral resistors at each station may be connected to any one of the transformer banks in order to establish the neutral for all transmission lines with various arrangements of the circuits. Circuit breakers between the two bus systems are normally operated open and the only connection between these two systems is made at the generator voltage. Normal operation of the high-voltage system is with lines and transformers connected to the main bus only.

(b) In addition to the bus section circuit breakers between the two bus systems, which are normally operated open, there are additional circuit breakers in the main bus which are normally kept closed for proper division of load, but which may be opened by the fault bus relays to minimize the extent of interruption in the event of a failure on any subsection of the bus.

station or distributing station, should some trouble arise which completely interrupts service on the low-voltage bus, the high-voltage system may continue to operate and carry energy to points beyond.

The usual drawback of a bus system is the inability to regulate voltage on the transmission lines. With a system such as this, where the circuits are underground cable with its relatively low impedance, regulation is not a serious item. The total difference in voltage between any two points on this 66-kv. system may be from 2 to 7 per cent, depending upon the amount and power factor of the load interchanged. It then becomes, in effect, a 66-kv. bus, extending practically from one end of the city to the other, with taps at various points where regulation must be provided on the transformers to take care of the local conditions only.

The principal problem in using a high-voltage bus system is the very high concentration of available short-circuit energy. With this concentration the most satisfactory protection against this high value of short-circuit current is phase isolation. The 66-kv. cables are made single conductor, for reasons of cable design, and this produces ready-made the principal element in isolation of phases. Single-phase transformers are desirable also for reasons of design simplicity and interchangeability. The only new step necessary to obtain an effective isolated phase system at 66 kv. was to adopt phase isolation at the terminals, with neutral resistors to reduce the short-circuit current. How this isolation has been accomplished can best be understood by observing the construction which has been adopted for use at the Crawford Avenue terminal.

The arrangements of the 66-kv. system as it existed during the winter peak of 1928-1929 and as it will exist for the peak of 1929-1930 are shown in Figs. 5 a and b; these diagrams indicate the rapid increase in the magnitude of this system. At each station a double bus is indicated, but the second bus is intended purely as an emergency connection to be used during maintenance work or other special operating conditions. Hence, only one circuit breaker is provided per line and per transformer.

Considering each station as a single-bus terminal, each is divided approximately in the middle by a circuit breaker for the purpose of separating the 66-kv. lines into red and blue systems to correspond to the sectionalization of the 12-kv. system. The breaker between the red and blue systems at the high voltage is not normally closed and the only tie between the red and blue systems is on the 12-kv. bus at the generating station or distributing station. This insures a quicker and more satisfactory separation between the systems in case a violent disturbance should occur. It also tends to insure that a disturbance which would require sectionalizing in one station may not necessarily separate other stations and will make no change in the conditions on the overlying interconnected system.

In any system of such magnitude stability is an important factor and quick operation of circuit breakers is needed to clear faults. One very effective feature which insures quick action where failures occur on the bus is the use of the fault bus at 66 kv. The adaptation of the fault bus to this structure was accomplished simply by providing insulation between the steel supporting structure and the ground and using this supporting structure as a fault bus. To make this effective, the steel structure is divided in sections which correspond in detail with the sections as arranged on the elementary bus diagram.

Circuit breakers are used in the main buses as well as between the red and blue systems, largely to improve efficacy of the fault bus. They will normally be operated closed, but in the event of a failure on a circuit breaker or a bus at any point, the relays will open all breakers connected to the corresponding subsection established by the additional breakers. These section

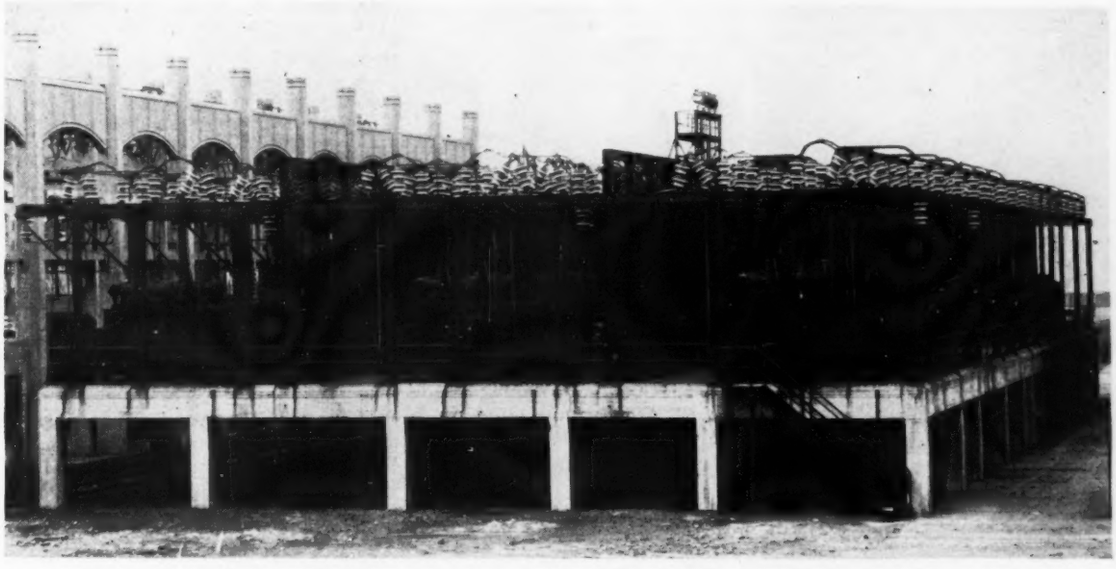


Fig. 6—66-Kv. Terminal at Crawford Avenue Station

Each line and each transformer is equipped with three separate single-pole circuit breakers instead of the usual three-phase breaker. The buses for the three phases are spaced widely apart with the breakers on each phase directly under the buses. As a further means of protection against flashover between phases a metal screen barrier has been erected between buses on adjacent phases. This barrier is connected to the fault bus system and any flashover which might occur on the bus or its appurtenances would first strike this screen or the supporting steel and cause the operation of the fault bus relays.

breakers are spaced closely so as to minimize the number of transmission lines or transformers interrupted.

The line relay operations are made uniformly rapid by the use of a pilot-wire system of protection. Since some of these lines are as much as 11 miles long, it was necessary to design a new type of pilot-wire protection, the selectivity of which is not affected by the arrangement of the lines. Differential protection is used for the transformers feeding this system; it will clear faults between turns in the main winding as well as short circuits between taps on the regulating units. During one or two minor failures which have occurred on transformers to date this differential protection cleared the fault with a minimum of damage.

Specifications for Structural Steelwork for Outdoor Substations

By E. A. Van Deusen

Structural Engineer Central Hudson Gas & Electric Corporation, Poughkeepsie, N. Y.

DESIGN

Outline and Height:

Outline and height of structures shall be such as will provide, in the most economical manner, sufficient clearance between conductors and steel, between all wires and cables, and will give proper overhead clearance, as may be required by the electrical engineer.

Loads:

The steel frame shall be designed to support safely and without undue deflection all dead and live loads, as noted below. If desired, girders shall be built with a camber so that when fully loaded they will be straight. A camber of 1/1,200 of the span gives good average results.

(a) Weight of conductors, insulators and electrical equipment, considering same to be covered with ½ in. of ice, plus deadweight of structure. The weight of ice shall be assumed at 57 lb. per cubic foot =0.033 lb. per cubic inch.

(b) A snow and ice load on girders of 15 lb. per square foot of top horizontal surface of girder.

(c) Each horizontal member in the structure shall be capable of supporting safely two 200-lb. men in the center of its span, in addition to loads (a) and (b).

(d) A wind load across the line of 8 lb. per square foot on all wires when covered with ½ in. of ice.

(e) A wind load on the structure of 13 lb. per square foot on 1½ times the projected area of the steel.

(f) Pulls in the direction of the line equal to the tension in the wires. The maximum pull from any wire shall be considered the same as its yield point.

(g) Special provision for unusual conditions of loading, such as angular line pull, uplift from line, impact, etc., are sometimes necessary.

Combined Loads:

All possible combinations of loads shall be considered and the structure designed to resist safely the maximum combination that can act under the given conditions.

Normal Unit Stresses:

All parts of the structure shall be proportioned so that no combination of loads can cause the stresses to exceed the following values in pounds per square inch, for the class of structure in question.

Main System Substations (A)

Axial tension, net section	18,000
Compression, gross section	$18{,}000 - 75\frac{l}{r}$ Maximum 14,000 lb.
Bending on extreme fibers	18,000
Shear on shop rivets	13,000
Shear on field bolts	12,000
Bearing on shop rivets	27,000
Bearing on field bolts	24,000

Distribution Substations (B)

Axial tension, net section	20,000
Compression, gross section	$18{,}000 - 70\frac{l}{r}$ Maximum 14,000 lb.
Bending on extreme fibers	20,000
Shear on shop rivets	14,000
Shear on field bolts	13,000
Bearing on shop rivets	28,000
Bearing on field bolts	25,000

Consumers' Substations (C)

Axial tension, net section	22,500
Compression, gross section	$18{,}000 - 60\frac{l}{r}$ Maximum 15,000 lb.
Bending on extreme fibers	22,500
Shear on shop rivets	16,000
Shear on field bolts	14,000
Bearing on shop rivets	30,000
Bearing on field bolts	27,000

The laterally unsupported length of beams and girders shall not exceed 40 times width of compression flange.

Maximum Slenderness Ratio:

The following ratios of unsupported length to least radius of gyration shall not be exceeded.

	Class of Structure A	B	C
Main compression members	140	160	180
Secondary members having calculated stress	200	225	225
Members having nominal stress only	250	250	250

Combined Axial and Bending Stress:

Members subject to eccentric axial loads, or to other loads producing both direct and bending stress, shall be proportioned so that the combined stress does not exceed the normal allowable unit stress for the class of member in question.

Alternate Stresses:

Members subject to alternate stresses of tension and compression shall be designed to resist each condition safely and their connections shall be proportioned likewise.

Net Section:

Tension members shall be proportioned by their net sections. Diameters of holes shall be taken as ¼ in. larger than undriven rivets or bolts.

DETAILS OF CONSTRUCTION

Adjustable Members:

Adjustable members in any part of the structure shall preferably be avoided.

Minimum Sections:

No metal of less thickness than ¼ in. shall be used in main members and $\frac{5}{16}$ in. in secondary members. No angle smaller than 2x2x$\frac{5}{16}$ in. shall be used.

Standard Sections:

Standard sections of I-beams, channels, angles, etc., shall be used in preference to special sections, when possible.

Connections:

So far as practicable, connections shall be capable of developing the full strength of the members, and shall be so designed as to avoid eccentric stresses. Any unavoidable eccentricity shall be provided for. No connection, except lattice bars and sometimes light diagonals, shall have less than two rivets or bolts.

Rivets and Bolts:

All shop rivets and all field bolts shall be not less than ¾ in. diameter, except for very light members. Holes shall be $\frac{1}{16}$ in. larger. Spacing and edge distance shall be in accordance with standard modern shop practice.

Joints in Columns and Tension Members:

Abutting joints in compression members faced for bearing shall be spliced sufficiently to hold connecting members accurately in place. All other joints in riveted or bolted work, whether in tension or compression, shall be fully spliced.

Column Base Plates:

Base plates shall be not less than ½ in. in thickness and shall be of sufficient thickness and size so that the pressure on the masonry shall not exceed the allowable pressure per square inch for the class of masonry in question.

Column Anchors:

Columns shall be anchored to the foundation by at least two anchor bolts, in general not less than ¾ in. in diameter, and placed as far apart as practicable in the plane of the greatest bending. The anchor bolts shall be designed to resist the net overturning moment at the base of the column.

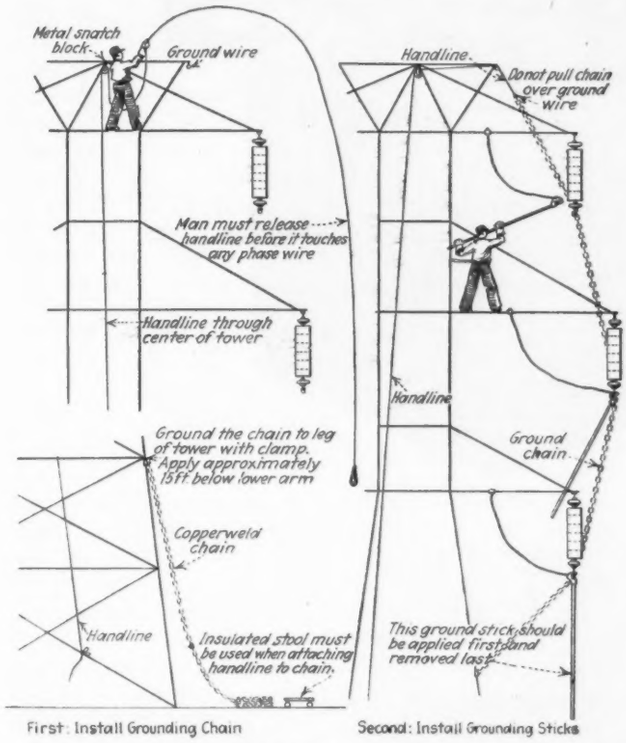
Foundations:

Foundations subjected to uplift shall be designed to withstand 1½ times the calculated uplift. In these designs it shall be assumed that each footing engages a frustrum of an inverted pyramid of earth which makes an angle of 30 deg. with the vertical. The weight of earth shall be assumed at 100 lb. per cubic foot and that of concrete at 150 lb. per cubic foot.

Foundations must be able to resist both vertical and horizontal loads, and soil pressures must be kept low enough so that there can be no injurious movement.

Ground Chains on Tower Lines Protect Workmen

THE approved method for protective grounding on 66- and 132-kv. steel tower lines of the Public Service Company of Northern Illinois when de-energized for protection to workmen is shown in the accompanying drawing. Three hot-stick clamps with permanently attached leads of No. 4 rubber-covered extra-flexible wire terminating in ground clamps are used. The chain is copperweld, 50 ft. long, with a ground clamp at one end. In applying the devices the following procedure is adhered to:


Metal snatch block
Ground wire
Handline
Do not pull chain over ground wire
Man must release handline before it touches any phase wire
Handline through center of tower
Handline
Ground chain
Ground the chain to leg of tower with clamp. Apply approximately 15 ft below lower arm
Copperweld chain
Handline
Insulated stool must be used when attaching handline to chain.
This ground stick should be applied first and removed last
First: Install Grounding Chain
Second: Install Grounding Sticks

Approved Procedure for Short Circuiting and Grounding 132-Kv. Lines

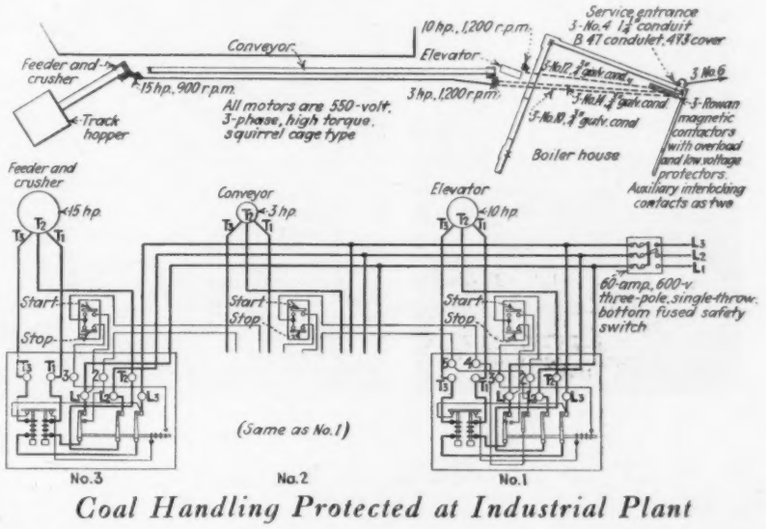
One end of the handline is tied to a bottom member of the tower and the other end is passed up through the center of the tower and through the snatch block; the slack is then gathered above the snatch block and thrown out over the power wires, thus making a loop from the bottom of the tower up the center thereof, through the snatch block, out over ground and power wires and back to ground. The men doing this must wear rubber gloves and release the hand line before it touches any conductor. The 50-ft. chain is then clamped to the leg of the tower at some convenient place below the bottom phase wire. The other end of the chain is attached to the hand line and pulled up so as to short all three phases, but must not touch the overhead ground wire. The man doing this must wear rubber gloves and stand inside the tower. A man on the tower pulls up the grounding set, placing the sticks in a convenient location on the tower. He then fastens one ground clamp on the lower tower arm; then, standing on the tower below the lower conductor, he applies the hot-stick conductor clamp to the lower conductor, after which he fastens the ground clamp to the middle arm and applies the conductor clamp to the middle conductor, standing on the lower arm while doing so. The man grounds the top conductor in the same manner while standing on the second arm. While applying and removing the conductor clamps with the sticks, the man doing so must wear rubber gloves, and no one is to come into personal contact with the conductors until they have been thoroughly grounded with these grounding devices.

Conveyor System Protected by Electrical Interlocks

IN ORDER to protect the operation of the coal-handling equipment and prevent a pile-up of fuel on any of the three parts of its coal-handling system an electrical interlocking scheme is used at the "fabrikoid" plant of E. I. du Pont de Nemours & Company, Newburgh, N. Y. Coal is brought from the feeder and crusher, which is driven by a 15-hp. motor, and delivered to the conveyor, belt-driven by a 3-hp. motor, which in turn feeds the elevator and by means of a 10-hp. motor delivers the fuel to the bin at the top of the boiler house, from where it is subsequently fed to the unit pulverizers for preparation.

As indicated in the accompanying wiring diagram it is necessary to start the elevator motor first. The interlocking contacts in this starter are then closed and starter No. 2 may be held closed. Similarly No. 3 may be operated. When motor No. 1 is shut down Nos. 2 and 3 may be jogged by holding in the start button. If motor No. 1 stops due to overload or similar factors motors No. 2 and 3 will shut down. If motor No. 2 stops, motor No. 3 will shut down, but No. 1 will continue running. When No. 3 stops motors Nos. 2 and 1 will continue running. This permits clearing of the apparatus upon the possible failure of one or more units.

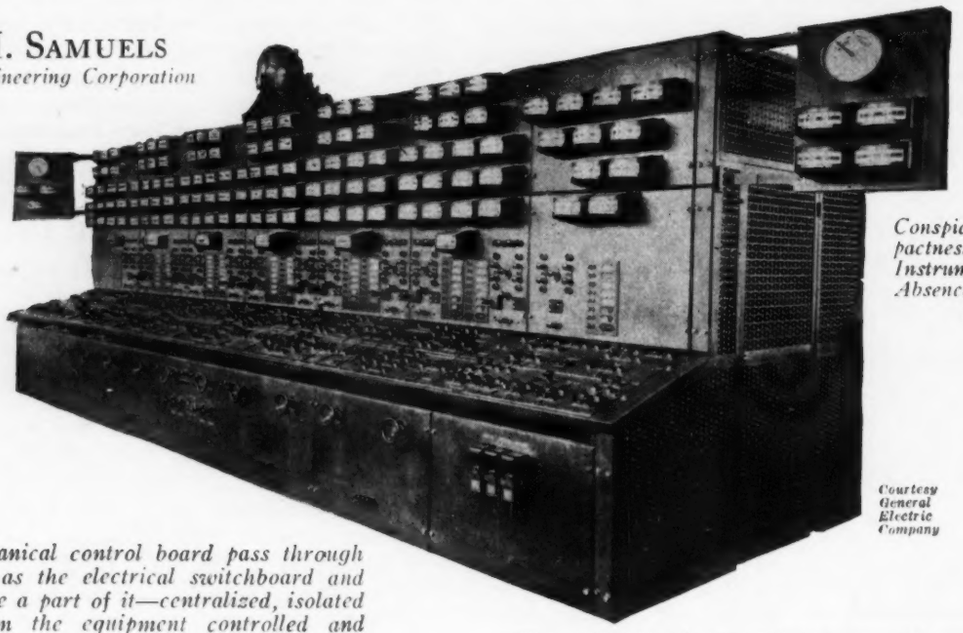
The push-button control is located in the boiler room, and according to E. C. Maloney, plant engineer, this offers a satisfactory and simple control, eliminating any difficulties with supply coal handling. Coal is fed to the crusher directly from the hopper bottom railroad cars. The grouping of the starting compensators at one point eliminates long runs of control wiring and centralizes any necessary maintenance.



Coal Handling Protected at Industrial Plant

Switchboard Evolution

By M. M. SAMUELS
J. G. White Engineering Corporation



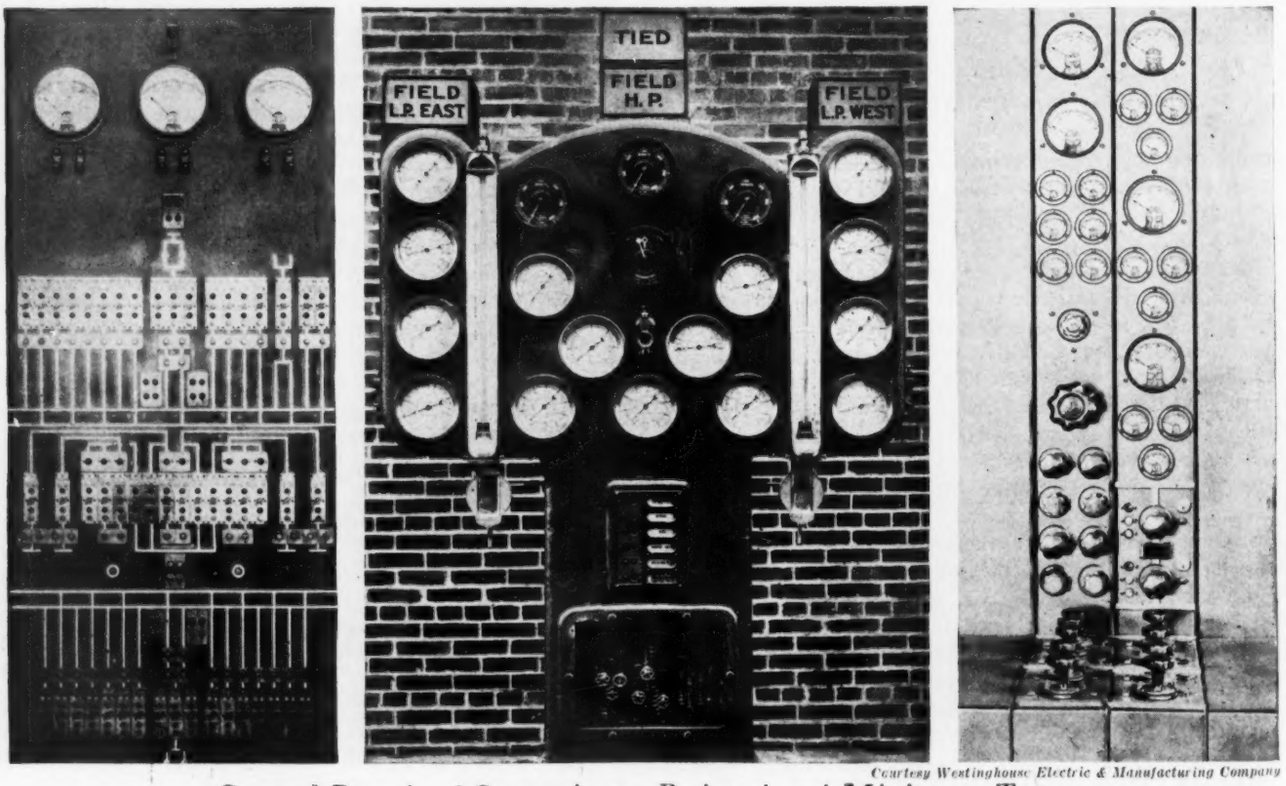
Conspicuous for Compactness, Uniformity of Instruments and the Absence of Recording Devices

Courtesy General Electric Company

Will the mechanical control board pass through the same stages as the electrical switchboard and eventually become a part of it—centralized, isolated and remote from the equipment controlled and supervised?

THE time is ripe for switchboard manufacturers to apply the skill and experience which they have accumulated in developing electrical switchboards to the control and instrumentation of the mechanical equipment in power houses.

The old idea of power house control was that the man starting, stopping or regulating any piece of equipment must stand alongside of it, have a feel of it, so to speak, and see every part of it. But soon equipment became so large that no matter where the operator stood, all he could see was a part of a casting or a few bolts of a coupling. Even switches themselves became so large



Courtesy Westinghouse Electric & Manufacturing Company

Control Boards of Supervisory, Pedestal and Miniature Types

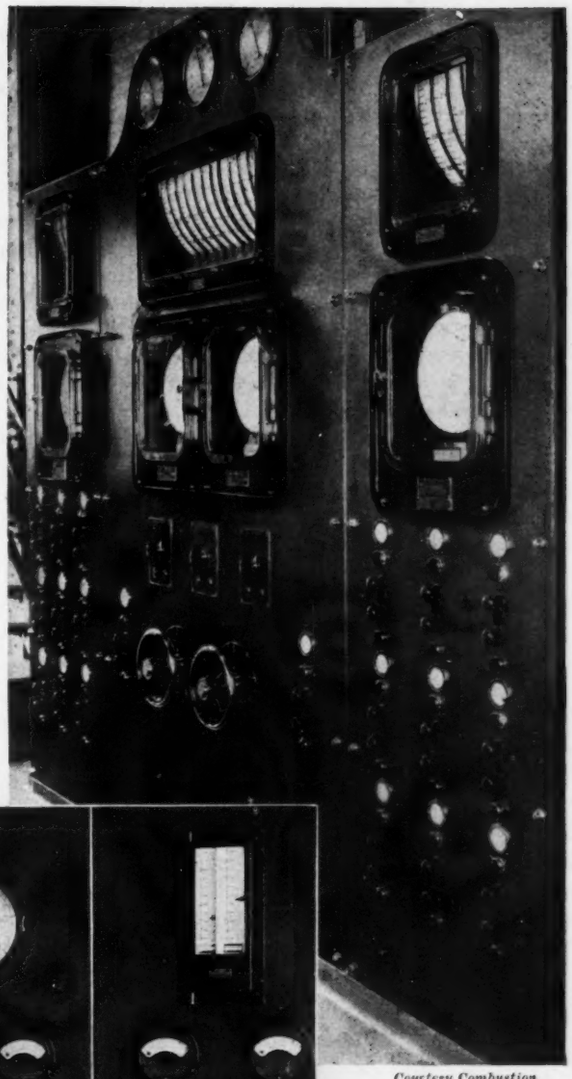
At left—Typical modern supervisory control switchboard. In center—Typical pedestal type gage board for large turbine, on which are also mounted the usual devices for signaling to switchboard.

At right—Latest design miniature control board. One 64-in. panel controls a large generator and another three feeders, using in each case three miniature ammeters per circuit instead of one ammeter and switch.

that the operator could see only a part of a switch tank or a piece of cell door. And yet the argument that the electrical operator must see the equipment controlled was very slow dying out and many a large power house shows what complications were brought about by the insistence that the control board must be on the same level with the turbines.

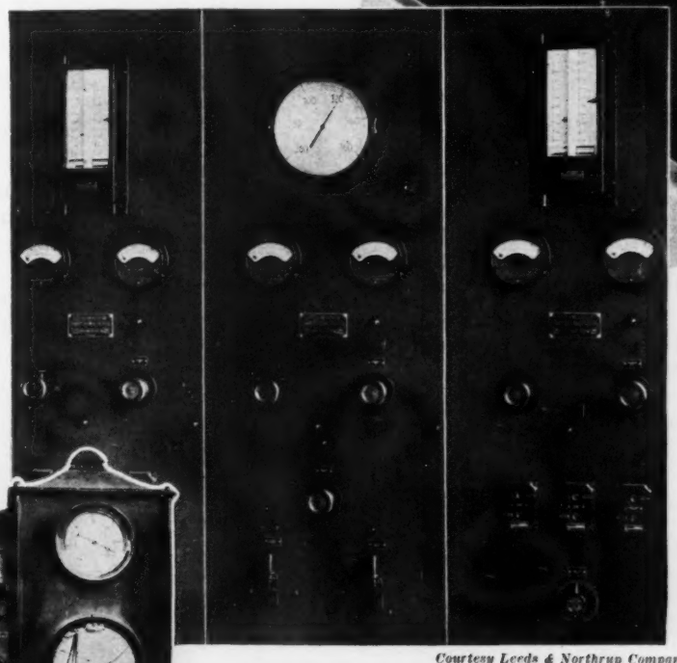
Electrical engineers quite generally have long since forgotten this argument, and centralized, isolated, remote control is now the only method thought of in the design of the electrical part of a station. The tendency is even toward the other extreme—to make the control board so small that the operator can supervise the entire thing without getting up from his seat. This is being accomplished by the elimination of all recording and regulating devices and relays from the control board and the use of very small indicating instruments, so that the operator can concentrate on watching his instruments and handles. Today he can supervise a 1,000,000-kw. plant (or even a whole system when using supervisory control) easier than he could a 2,000-kw. plant in the past.

Mechanical engineers, however, seem to be holding on to the old argument. They are very slow in adopting centralized control, although, after long hesitancy, they are now generally using piping diagrams, which are made up along the lines of the electrical one-line diagram. But what does the man at the throttle of a big turbine really see? Not much of anything He has to use a great deal of effort to read the huge instruments on the somewhat remote gage board, when a 2½-in. instrument in front of his nose would have been easier to read. The boiler man has to crane his neck to see the water column and bend his back to read a steam gage. Even peeping at the fire is more of a hobby, nowadays. Combustion is not controlled in big power houses by a peep at the fire and a shovel of coal. And the man who starts a circulating pump or large fan or a boiler feed pump really does not see much more than the push-button box. He might as well be in a separate control room. And in a separate control room he will be some day.



Courtesy Combustion Engineering Corporation

Controls Pulverized-Fuel Boiler and All Accessories



Courtesy Leeds & Northrup Company

Panels Used with Automatic Combustion Control

Instruments Have to Be Large to Be Read from Turbine

Courtesy General Electric Company

Some attempts to isolate and centralize mechanical control and instruments have already been made, but they are still crude. It needs the skilled hand of the switchboard designer to crystallize and systematize the idea. It needs the development of small-scale steam gages, vacuum gages, pressure gages, flow meters and other instruments, all of uniform design,

before a really good control board can be built. But it will be built. Time will tell whether the mechanical control board will be in a separate room, under the supervision of a separate operator, or possibly more radical and be a part of the electrical control board under the supervision of the same operator.

These remarks must not be misconstrued as advocating the reduction of the number of employees in a steam plant as a principle. Any one who is foolish enough to attempt to make a record and slice off a fraction of a mill per kilowatt-hour by reducing the number of employees in a power house in which millions are invested is flirting with fire. A certain amount of help there must be, ready for emergencies, even if it should have to loaf a great deal of the remaining time. But the employees need not loaf. They can be kept busy inspecting, repairing and cleaning, with emphasis on the cleaning. What is suggested and what is bound to be in general use very soon is centralized remote control of all mechanical equipment, and it is logically a problem for the switchboard designer to solve.

Selection of Cable Capacity for Substations*

IT IS felt that the two parts of an electric system most intimately inter-related in their layout and design are the transmission system and the substation. The problem is to decide upon a second type of spare capacity, such as one cable circuit to each substation and one transformer bank and one single-phase transformer spare in each substation and then to lay out the system in such a manner as to keep the percentage of spare to the minimum and at the same time utilize equipment having the maximum economy consistent with a low percentage of spare.

It will be noted in the table that care is required in both the initial and ultimate layout of a system to secure a balanced design, otherwise a considerable excess in cable capacity will be installed. One spare cable to a substation will undoubtedly be the minimum spare capacity unless the distribution system is so designed as to permit the entire substation functioning as a spare.

**From material compiled by electrical apparatus committee, substations subcommittee, N.E.L.A., L. G. Smith chairman.*

Laboratories Chief Raises Questions Regarding

Rubber Gloves

1. Is there a real need for the two classes of rubber gloves now used in the industry and, if so, why?
2. Are so-called surface defects being given too much attention and can the electrical test be taken as the sole criterion?
3. If surface defects are a hazard, or may become so under the conditions of use, what concrete reproducible standard for acceptability can be set up?

(Perhaps a method of making gloves will be devised which will result in an absolutely uniform product so far as appearance is concerned, but certainly at the present time this matter of so-called surface defects is one of the most troublesome factors in the acceptance inspection of gloves.)

4. Just how effective are gloves as a protection? In other words, how many minor and major failures of gloves to afford complete protection occur per year in terms of the total number of gloves in actual use?
5. Are or are not gloves improving as to the protection being afforded?

F. M. FARMER,
Chief Engineer Electrical Testing Laboratories.

Obviously, higher voltages than 13,000 would be impractical if substation capacities are small. Likewise, for supplying small substations the smaller conductor sizes should be used.

In making a decision as to the size and voltage of cable to supply substations it is necessary to consider the over-all economies of system design, taking into consideration the economical side of substation and the proper electrical cable capacity so as to reduce to a minimum the margin of excess cable capacity above substation peak loads.

Number of Cables of Various Sizes and Voltages Required for Various Sizes of Substations

	Size of Substation, Kva.	26,000 Volt 350,000 Circ. Mil. Total Cable Capacity		26,000 Volt 211,600 Circ. Mil. Total Cable Capacity		26,000 Volt 105,600 Circ. Mil. Total Cable Capacity		13,200 Volt 500,000 Circ. Mil. Total Cable Capacity		13,200 Volt 350,000 Circ. Mil. Total Cable Capacity		13,200 Volt 211,600 Circ. Mil. Total Cable Capacity		13,200 Volt 105,600 Circ. Mil. Total Cable Capacity	
		No.	Capacity	No.	Capacity	No.	Capacity	No.	Capacity	No.	Capacity	No.	Capacity	No.	Capacity
15,000-Ft. Length Six-Duct Bank	3,000	2	21,080	2	16,020	2	10,980	2	14,860	2	12,120	2	9,260	2	6,260
	6,000	2	21,080	2	16,020	3	16,470	2	14,860	2	12,120	3	13,890	3	9,390
	9,000	2	21,080	3	24,030	3	16,470	3	22,290	3	18,180	3	13,890	4	12,520
	12,000	3	31,620	3	24,030	4	21,960	3	22,290	3	18,180	4	18,520	5	15,650
	15,000	3	31,620	3	24,030	4	21,960	3	22,290	4	24,240	5	23,150	6	18,780
	18,000	3	31,620	4	32,040	5	27,450	4	29,720	4	24,240	5	23,150	7	21,910
	21,000	3	31,620	4	32,040	5	27,450	4	29,720	5	30,300	6	27,780	8	25,040
	24,000	4	42,160	4	32,040	6	32,940	5	37,150	5	30,300	6	27,780	9	28,170
	27,000	4	42,160	5	40,050	6	32,940	5	37,150	6	36,360	7	32,410	10	31,300
	30,000	4	42,160	5	40,050	7	38,430	5	37,150	6	36,360	8	37,430	10	31,300
	40,000	5	52,700	6	48,060	8	43,920	7	52,010	8	48,480	10	46,300	13	40,690
15,000-Ft. Length Twelve-Duct Bank	3,000	2	17,080	2	12,960	2	9,100	2	11,880	2	9,780	2	7,450	3	7,740
	6,000	2	17,080	2	12,960	3	13,650	2	11,880	3	14,670	3	11,175	4	10,320
	9,000	2	17,080	3	19,440	3	13,650	3	18,820	3	14,670	4	14,900	5	12,900
	12,000	3	25,620	3	19,440	4	18,200	3	17,820	4	19,560	5	18,625	6	15,480
	15,000	3	25,620	4	25,920	5	22,750	4	23,760	4	19,560	5	18,625	7	18,060
	18,000	3	25,620	4	25,920	5	22,750	4	23,760	5	24,450	6	22,350	8	20,640
	21,000	4	34,160	5	32,400	6	27,300	5	29,700	5	24,450	7	26,075	9	23,220
	24,000	4	34,160	5	32,400	6	27,300	5	29,700	6	29,340	8	29,800	10	25,800
	27,000	4	34,160	5	32,400	7	31,850	6	35,640	7	34,230	8	29,800	11	28,380
	30,000	5	42,700	6	38,880	8	36,400	6	35,640	7	34,230	9	33,525	22	30,960
	40,000	6	51,240	7	45,360	10	45,500	8	47,520	9	44,010	12	44,700	16	41,280

N. Y. "Times" Presses Use Special Starting Control

By J. A. Hepperlen
Industrial Control Engineering Department, General Electric Company

THE New York *Times* has a Wood super-speed octuple printing press capable of producing 60,000 papers per hour, a speed increase of 50 per cent over the previous high-speed press. It has a special double-motor drive. The main motor is rated at 250 hp., 325/995 r.p.m., 240 volts direct current and the starting motor is rated at 15 hp. and has a 38 to 1 gear reduction. The starting motor is used for starting, jogging and threading. The main motor is used for accelerating and carrying the load above the threading speed. Since the torque rises with the speed, the increased power required to drive a high-speed press occurs along the speed range handled by the main motor. The requirements on the starting motor are not materially affected.

The control follows standard lines, but involves some special features. The pilot motor which drives the switch arm controls the time of accelerating the main motor and this is operated only while one of the "Fast" push buttons is pressed. The important thing is to bring the press up to its maximum speed in the shortest time without injury to machinery or possibility of delay from tearing a web. The pilot motor speed cannot be timed to meet every condition of load unless it is geared down to meet the heaviest accelerating condition, which would make it too slow for lighter loads, unless the pressman is depended upon to jog the "Fast" push button so as to bring the press up to speed by steps. This latter case brings in the human factor, which may mean, in case of overcaution, a loss of five or ten seconds in getting the press under way, or a broken web in case of overzeal to get the papers on the street.

The operation desired was obtained by using a compound relay for automatically limiting the pilot motor travel. This relay has a coil wired in series with the main motor and a coil connected across the shunt field. Each coil has an adjustable air cap and both act on a common armature. When the motor accelerates the load current increases as the shunt field strength is weakened. Thus a rise in inrush current is necessary to offset the increased load. The voltage drop across the shunt coil compensates for a higher current in the series coil for the same pull on the relay armature. With proper adjustments of the air gaps, the relay can be set to give the best rate of acceleration without lost time regardless of load.

Overhead Line Costs

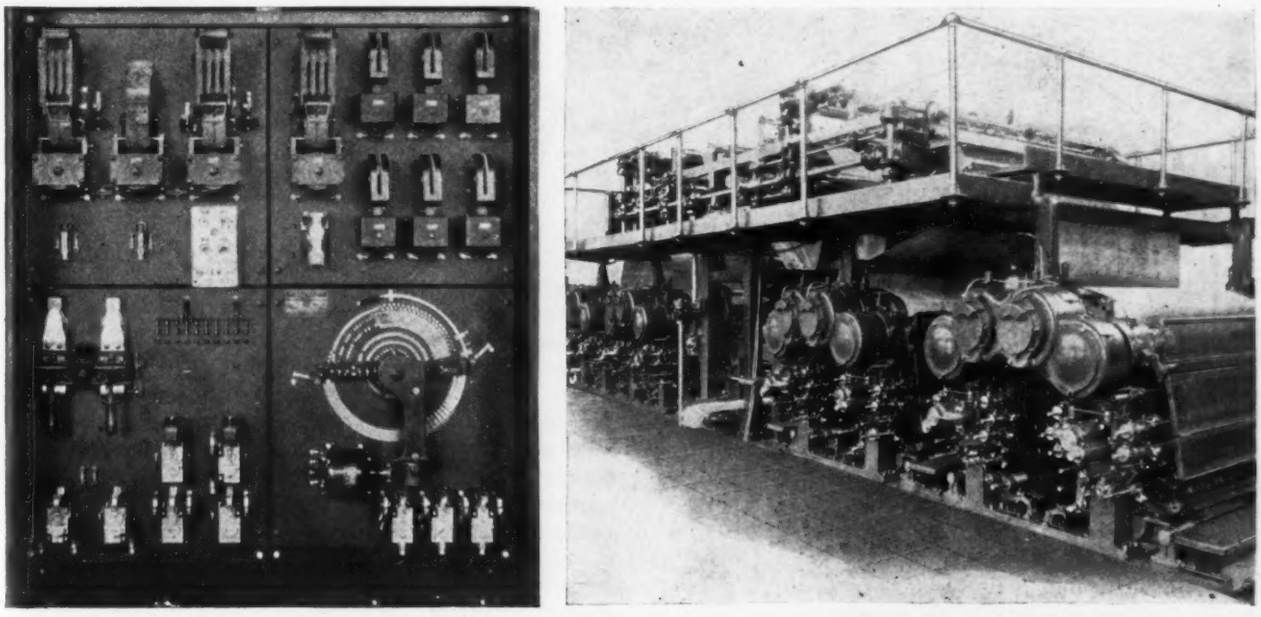
DATA sheets on costs of various types of overhead line construction are furnished by a large Middle Western utility to its divisional managers and other employees who may be called on to estimate costs of line extensions. They are thus able to compile budget figures or judge of the advisability of extending lines without recourse to the central operating office. We present here a recapitulation of the sheets so far issued by the company, in which are shown the unit costs per mile for several types of overhead line construction.

Costs per Mile of Overhead Lines

2,300 volts	Two No. 6 wires 30-ft. poles spaced 175 ft	$1,281.00
2,300 volts	Three No. 6 wires 30-ft. poles spaced 175 ft	1,396.00
2,300 volts	Two No. 4 wires 30-ft. poles spaced 175 ft	1,406.00
2,300 volts	Three No. 4 wires 30-ft. poles spaced 175 ft	1,576.00
33 kv.	Three No. 4 wires 30-ft. poles spaced 175 ft	2,068.00
33 kv.	Three No. 4 wires 35-ft. poles spaced 175 ft	2,200.00
33 kv.	Three No. 2 wires 30-ft. poles spaced 200 ft	2,271.00
33 kv.	Three No. 2 wires 35-ft. poles spaced 200 ft	2,362.00
33 kv.	Three No. 1 wires 30-ft. poles spaced 225 ft	2,370.00
33 kv.	Three No. 1 wires 35-ft. poles spaced 225 ft	2,447.00

Telephone Line Underbuilt on 33-Kv. Line

No. 8 H.D. copper	$275	No. 10 Copperweld	$191
No. 6 H.D. copper	352	No. 8 Copperweld	250
No. 7 A.C.S.R.	247		



Push-Button Control and Compound Relay Operate Super-Speed Press

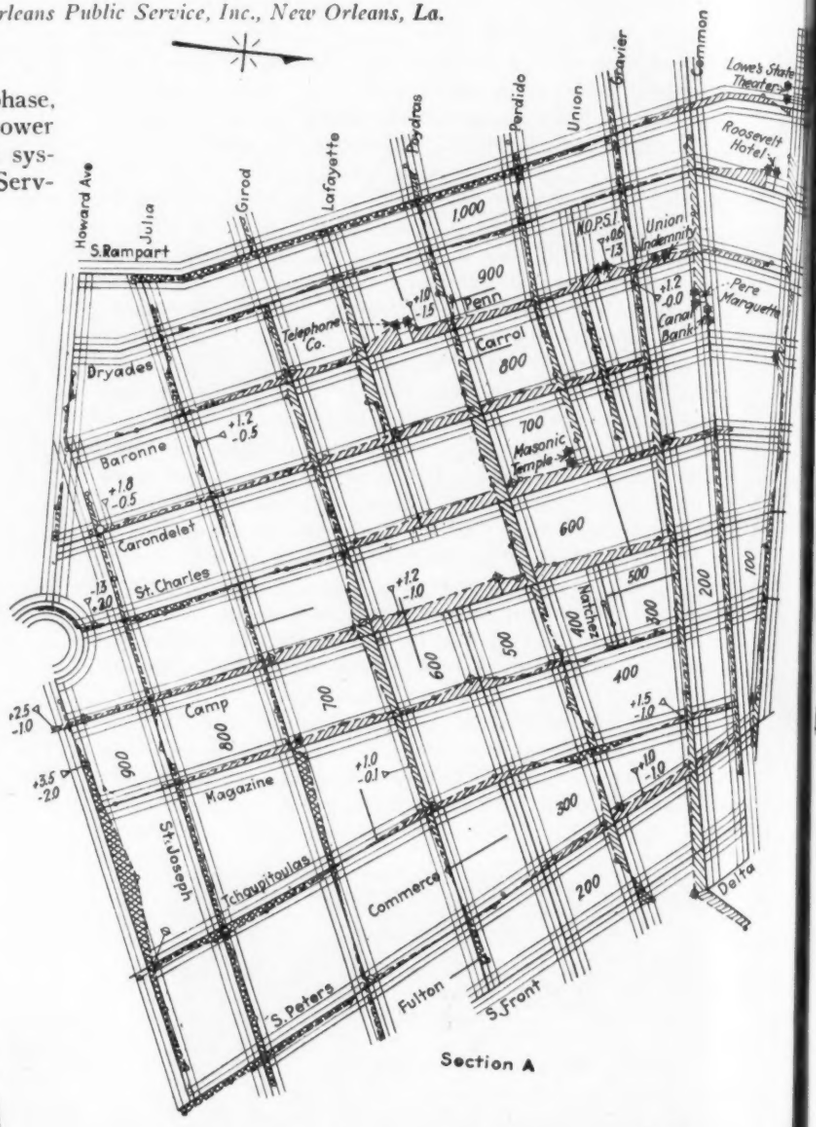
Network Voltages Maintained

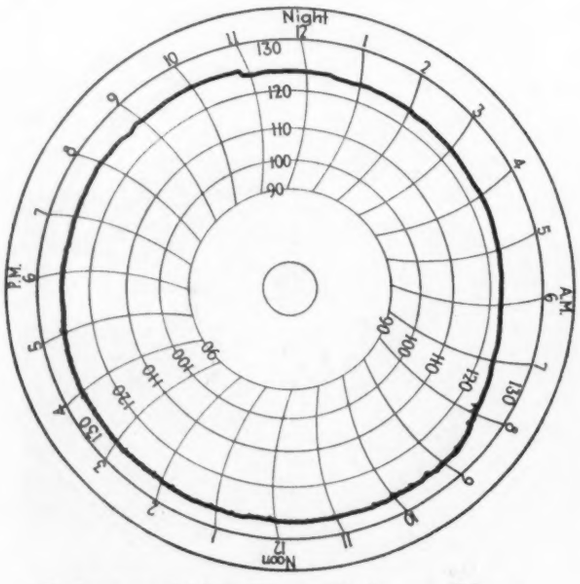
Check of New Orleans grid shows only small deviations from 120-volt base to be expected from variations of load density in the area. Observed service voltage range during survey is 3 per cent plus to 2 per cent minus

By C. I. HENDRICKS

Underground Engineer New Orleans Public Service, Inc., New Orleans, La.

A COMPLETE voltage survey of its three-phase, four-wire underground combined light and power (120-208 volts) alternating-current network system was recently made by the New Orleans Public Service, Inc. The object was to determine what voltages existed at customers' services under normal operating conditions with all primary feeders in service. The survey was prompted by the division of opinion among distribution engineers as to the correct value of reactance for transformers used on this class of service. Transformers with reactance of the order of 10 per cent, which are used on the New Orleans system, possess certain advantages from the standpoint of uniform distribution of current over transformers having lower values of reactance. This statement is, of course, general and its truth depends upon the ratio of secondary cable reactance to the transformer reactance. It is correct for transformers having inherent reactance, but not necessarily true for transformers having added external reactance. In the latter case the external reactor may be so designed as to become saturated at a current value far below the maximum current values the transformer would have to supply in cases of severe secondary system failures.





Primary (13.2 Kv.) Voltage Chart

Values expressed in terms of the secondary. This chart includes the drop through transformers and secondary mains to service points. Variations are caused by regulator operation.

From a regulation viewpoint, however, transformers of lower reactance have certain advantages over the higher reactance type in instances of varying loads and power factors at different points on a network system. This applies particularly to a growing system where the necessary network is not complete and where the transformer banks are spaced at intervals relatively large in comparison with the ultimate spacing. By the use of various sizes of transformers the matter of non-uniformity of load can be remedied. This practice stands in question, however, by the fact that several companies operating network systems are standardizing on one size of transformer.

The area of the underground district in the city of New Orleans is approximately 2 miles in length and ½ mile in width. For convenience of explanation, the area is divided into two sections, namely, "A" and "B." Section "A" is that part above Canal Street, which is the newer portion of the district. Section "B" is below Canal Street, in the lower portion of the district, where buildings are of the semi-residential type. Consequently, the load density is considerably lower than in section "A."

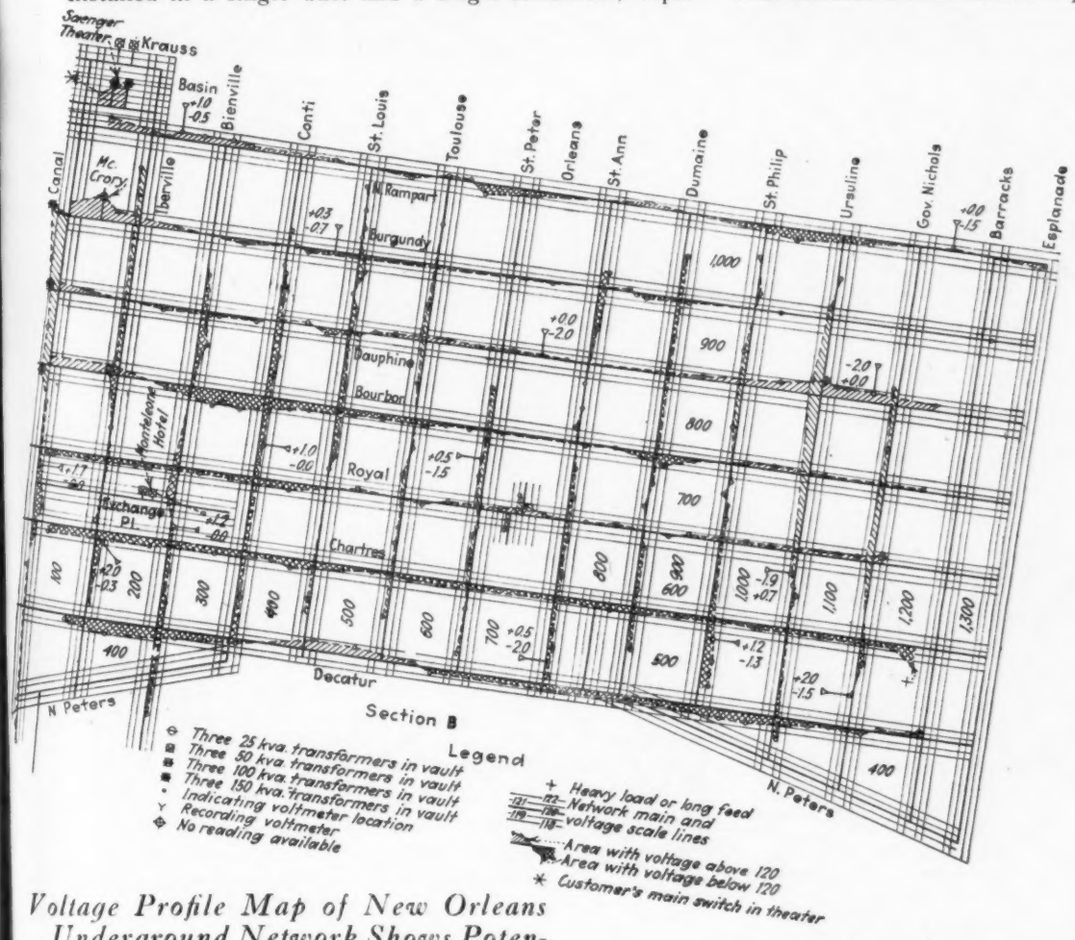
The secondary system in general consists of three single-conductor, rubber-insulated, lead-sheathed cables installed in a single duct and a single-conductor, triple-braid, weatherproof neutral cable installed in a separate duct. All like phase and neutral conductors are joined together solidly at each street intersection so as to form a rigid interconnected grid. In section "A" 500,000-circ.mil cables are used for both phase and neutral conductors, while in section "B," where the load density is less, No. 4/0 conductors are used.

The primary system at the present time consists of four 13.2-kv. regulated radial feeders direct from a common bus at the Market Street generating station. Each feeder from the generating station to the point of feed consists of one No. 4/0 A.W.G. three-conductor, $\frac{13}{64}$-in. x $\frac{13}{64}$-in. paper-insulated cable. The backbone of the primary main consists of three No. 2/0 A.W.G., $\frac{29}{64}$-in. paper-insulated, single-conductor cables. The primary laterals consist of three No. 3 A.W.G. $\frac{29}{64}$-in. paper-insulated, single-conductor cables.

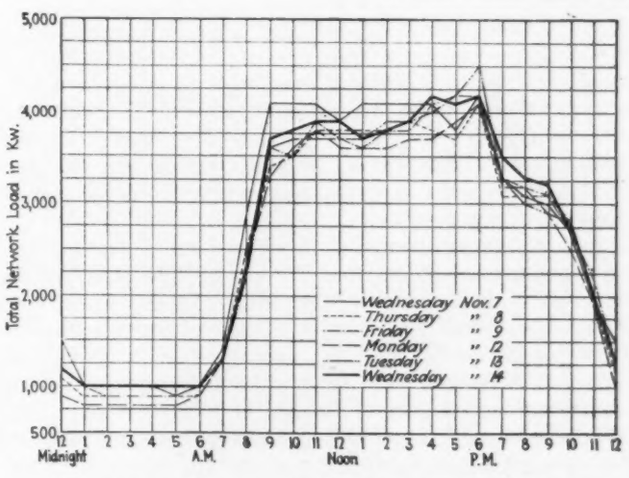
The feeder regulators are of the single-phase induction type and are rated at 195 kva., 150 amp., 10 per cent buck or boost. Each feeder is equipped with two regulators, open-delta connected and mechanically interlocked, resulting in equal voltages on all phases of any particular feeder at all times. Electrical cross compensation is provided between all feeders.

The transformers are of the subway type, 10 per cent reactance, and in sizes of 25, 50 and 100 kva. In a few special instances, where concentrated loads in excess of 300 kva. exist, 150-kva. transformers are used. The total connected transformer capacity on the network system at the time of writing is 11,250 kva. The maximum demand on the system up to date is 6,000 kw. at 92 per cent power factor. In order to secure an accurate index of the network voltage profile it was necessary to obtain a multitude of voltage readings in uniform order over the network system. Due to the large number of readings required and the limited number of recording voltmeters it was found necessary to resort to the use of indicating voltmeters.

Since it was practically impossible to cover the entire network in one day it was first necessary to determine the variation in the daily network load. The total network load for each week-day hour was averaged daily for a period of one month. It was found that the



Voltage Profile Map of New Orleans Underground Network Shows Potentials at Customers' Services



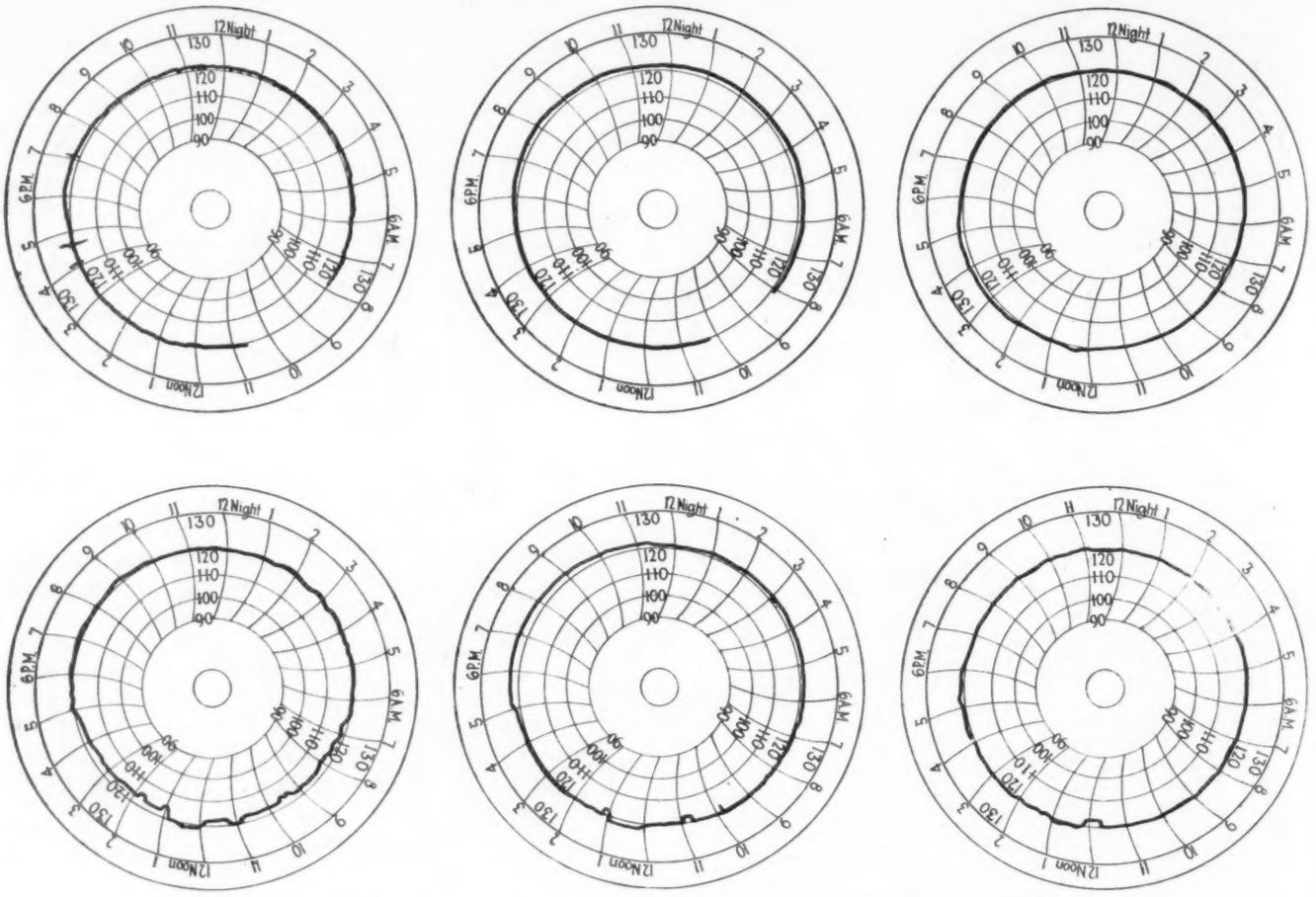
Loads on Network During Days When Survey Was in Progress

minimum variation from weekday to weekday occurred between 2 and 3 p.m. It was therefore decided to conduct the test during this hour. The network regulators were locked in the position taken at 2 p.m. Since the 13.2-kv. bus voltage at Market Street station is constant, the voltage readings were therefore comparable throughout the hour.

Seven indicating voltmeters were used during the test, six for readings at customers' service points and one for readings at transformer vaults. A total of 519 service point readings were taken over a period of six days. After correcting the voltage readings with the calibration curves of the voltmeters the average of phase readings to neutral was taken as the voltage value for each test location. Several graphic recording voltmeters were installed at random on the network during the test days for the purpose of securing the regulation of the system over a 24-hour period.

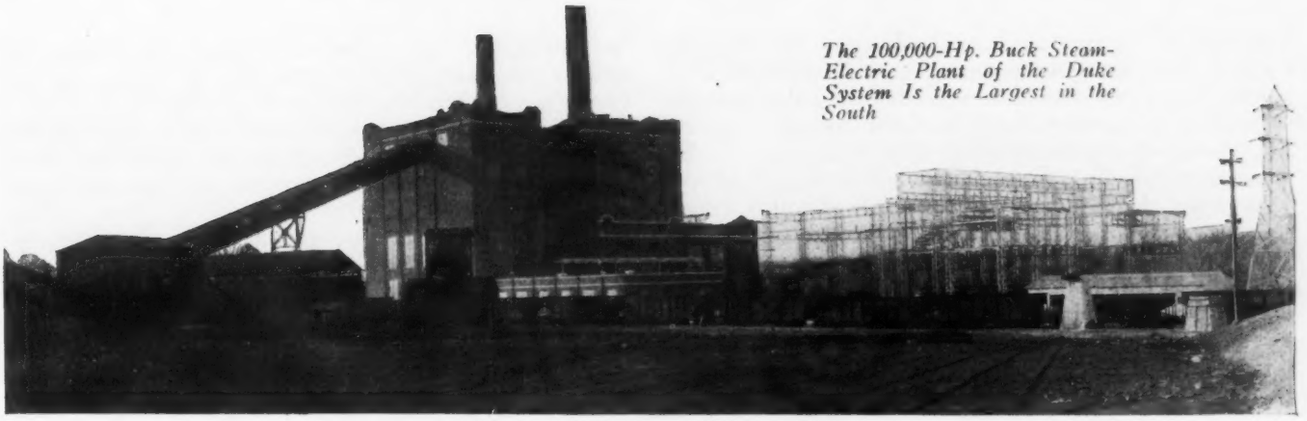
A complete summary of the test is shown on the voltage profile map. The network mains are indicated by the 12-volt base lines of the voltage scale. The lines above and below the base line are voltage scales with values above and below 120 respectively. A continuous dashed profile line has been drawn along each street connecting all locations where readings were taken. Shaded portions above and below the base line indicate the voltage differences over the various sections of the network. The voltage variation as obtained from the graphic charts, for each location, is indicated by positive (+) and negative (—) values on the map. These values added to or subtracted from the profile voltage, at a particular graphic voltmeter location, give the respective maximum and minimum voltage values over a 24-hour period.

The hourly variation in the network load during the days of the test is shown by the load curves. The difference in loading between 2 and 3 p.m. of the different days is believed negligible in so far as it affects the secondary voltage. There are, of course, certain customers whose load may have varied considerably during the test period. However, the indicating readings, substantiated by the graphic readings, are typical of the general voltage conditions on the entire network system.



Twenty-four-Hour Variations of Voltage at Service Points

The average of 519 service voltage readings was 119.9 (207.5 between phases). The minimum indicated voltage obsered at a service point was 117.5, or 2 per cent below 120, and the maximum 123.5, or 3 per cent above 120. The 24-hour voltage variation obtained from the graphic chart is 120 plus 3 per cent or minus 3.5 per cent. It must not be inferred that these latter figures represent the general voltage conditions on the entire network. It is only in a few isolated instances that there is this variation from the nominal voltage of 120. Low-voltage locations will be gradually corrected, either by the addition of transformer vaults or replacement of existing transformers by those of a larger kilovolt-ampere capacity, while additional future loads will correct the higher voltage locations.



The 100,000-Hp. Buck Steam-Electric Plant of the Duke System Is the Largest in the South

How the Duke Power Company Is

Increasing Its Sales

Power sales increased 20 per cent in 1928. National advertising helps develop industry. New factories come at rate of one every five days during the year

By ROBERT S. CLARY
Charlotte, N. C.

THE Duke Power Company is increasing its sales by developing the interest of prospective industrial customers in three ways—through advertising, through personal contact and through working with the chambers of commerce in the 160 industrial communities it serves.

It co-operates at every opportunity with the various organizations in its territory—sending them frequent lists of industrial and commercial inquirers, supplying them with booklets and community-selling literature and leaving no stone unturned to help those bodies further the economic development of their respective areas. It does not send out emissaries to other states and territories or use any high-pressure salesmanship whatever in inducing industrial plants to move to Carolina, but it does make frequent contacts with the representatives of interested industries who request information about particular communities.

This company's chief way of increasing sales, however, is through national advertising. Not content to serve merely those industries already located in its territory and being unable to "export" its product, the company's far-seeing officials decided to try to "import" additional customers—through national advertising.

Types of industries particularly sought by this aggressive company include all for which the various industrial communities in the Piedmont section of North and South Carolina are especially advantageous, notably textile, furniture, tobacco, ceramic, paint, meat packing and various miscellaneous industries for which unusual opportunities exist.

To interest these outside industries the Duke company offers no inducements other than the natural advantages of labor, climate, raw material and markets. It has been this company's experience that a low power rate may be important in determining the location of new industrial plants in a territory, but that a low rate alone will seldom attract industries to a section that does not possess other more important production advantages.

Although the Duke company is not primarily interested in immediate results, preferring to look forward 25 to 50 years, its efforts have already witnessed an influx of new industries—hosiery mills, silk mills, rayon mills and a host of textile specialties, such as mills manufacturing bedspreads, brocades, tapestries, towels, handkerchiefs, curtain material and other related and allied industries.

The Duke Power Company, with 3,500 miles of transmission lines throughout Piedmont Carolinas, last year sold 1,745,776,000 kw.-hr. of energy to 160 industrial communities. Because of its modern merchandising methods, this 23-year-old company is already one of the six largest—and, in transmission mileage, probably the very largest—of the power companies in the United States.

This informing article, which is based on personal interviews with John Paul Lucas, industrial manager of the Duke Power Company, relates in detail how this company is increasing its sales so rapidly.

So rapidly, in fact, have new industries come into the territory that the Duke company sold 20 per cent more power last year than the year before, although the nation's average was only 7 per cent, and 10 per cent is generally considered a good, healthy increase. This unusual increase in power sales, which is nearly 300 per cent greater than the nation's average, is due almost altogether to the industrial development which is taking place in Piedmont Carolinas, a development which the Duke company is aiding and abetting with all its power. Typical of this development throughout the utility's territory, ten years ago the textile industry of the city of Charlotte (in which are located the Duke company's headquarters) consisted only of cotton hosiery, cotton yarn, sheetings, ginghams, overalls and waste. Today Charlotte's textile mills make not only sheetings, yarn and overalls, but also full-fashioned silk hosiery, seamless silk hosiery, silk weaving, towels, upholstery materials, rayon-cotton dress goods, narrow fabric, draperies, handkerchiefs and many other textile products.

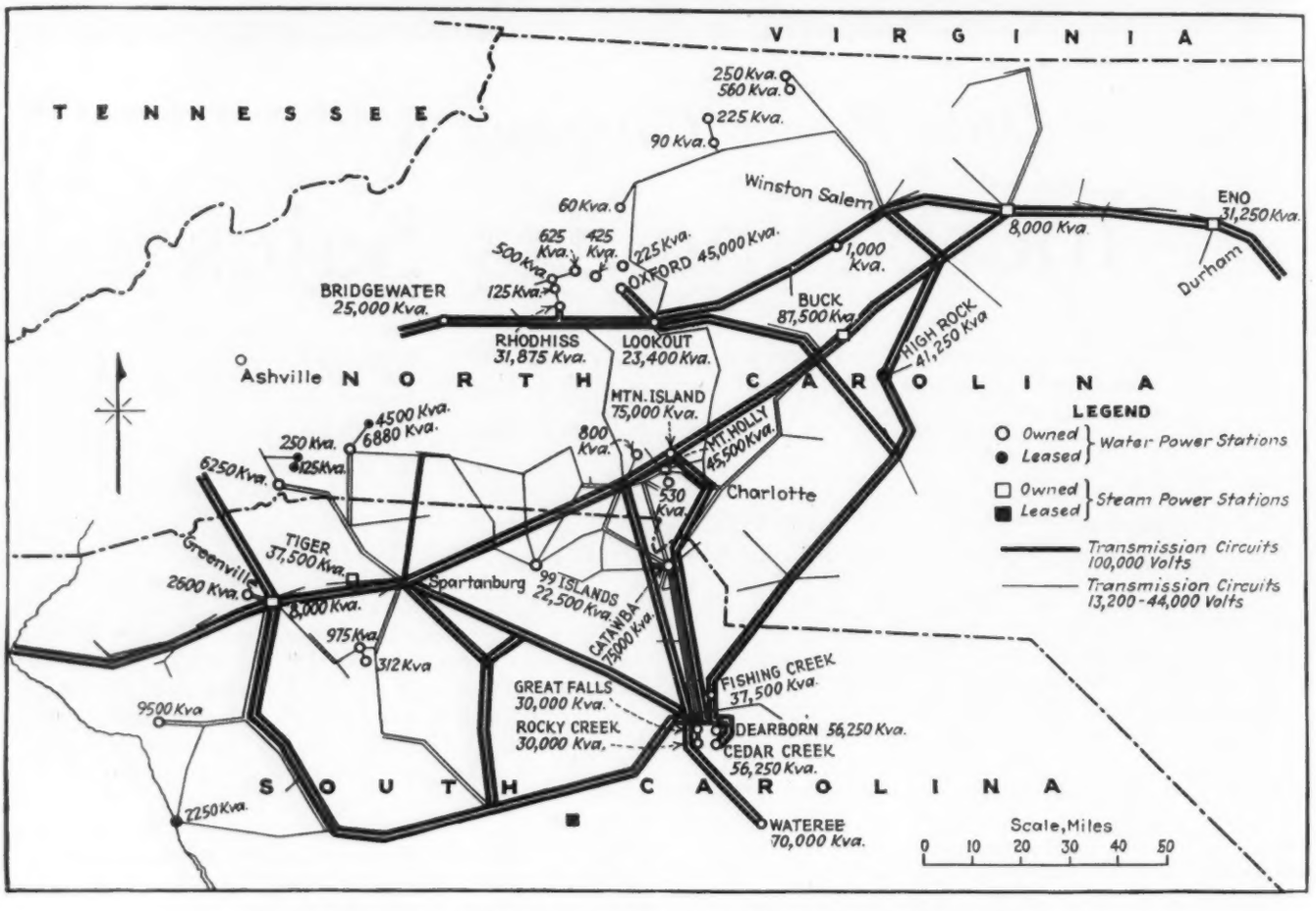
To supply the power needs of this amazing industrial development throughout its territory the Duke company last year transmitted 1,745,776,000 kw.-hr. of energy over more than 3,500 miles of transmission lines to 160 thriving industrial communities and to many other isolated mills and factories.

How is Duke accelerating this development? Largely by advertising.

In April, 1927, the Duke company launched a national campaign to sell, not its own product, power, but the inherent manufacturing advantages of its community. Its intelligent, continuous, consistent advertising has already produced 1,946 inquiries, 1,129 during the first twelve months and 817 during the past six.

These immediate, traceable returns have far exceeded expectations and have proved conclusively to the officers of the company that this type of advertising pays highly gratifying dividends.

The Duke Power Company does not claim that its advertising is wholly or even partially responsible for the remarkable industrial expansion of the Piedmont Carolinas during the past two years. But the fact remains that for the first time in all history manufacturing plants have been attracted to this section at the rate of one every five days for the past twelve months.



Transmission System of the Duke Power Company

With becoming modesty the company claims no results for its advertising, but gives all the credit to its various communities' natural assets. In its advertising copy it enumerates the various reasons which the company believes are responsible for this migration of industries.

"Piedmont Carolinas is 300 miles closer to the nation's center of population than is New York City," states a typical advertisement. "A 600-mile shipping radius—the economical marketing circle—centered on New York City reaches 44.5 per cent of the total purchasing power of the United States. A similar circle, drawn from Piedmont Carolinas, reaches 66.8 per cent of the country's purchasing power. Piedmont Carolinas' available market is greater by 50.1 per cent. Moreover, it is a fact that production costs in Piedmont Carolinas are 10 and 26 per cent lower than in old, highly industrialized sections of the country. With costs 10 to 26 per cent

lower, and market availability 50 per cent greater, you have a combination that wins and holds markets."

Each of the Duke advertisements pictures a booklet entitled "Piedmont Carolinas—Where Wealth Awaits You," and suggests that the interested industrial executive write for it. This booklet contains 48 pages of simply stated facts: Where and what Piedmont Carolinas is; its wealth, manufactures, banking and mercantile resources, population, availability, markets; its raw materials, labor, power, transportation, industries; climate, living conditions, and outstanding opportunities.

A passage on textiles discloses that "The present $500,000,000 annual output of Piedmont Carolinas' textile mills is not the result of accident, but of sound economic factors that have worked out with inexorable force to bring more and more looms and spindles to this region. Lower overhead, intelligent labor and economical power meet in the midst of the Piedmont's upland cotton fields.

"When we examine a few figures of the two Carolinas separately, we find that either one or the other holds the following rank in the textile industry among all the other states of the Union:

First in number of active spindle hours.
First in number of active mills.
First in number of wage earners.
First in dollars paid for wages and salaries.
First in value of finished product.
First in the manufacture of denims, canton flannel, flannelettes, blanketings, towels, towelings, wash cloths, bath mats, sheets, pillow cases, table damask and commercial yarns.

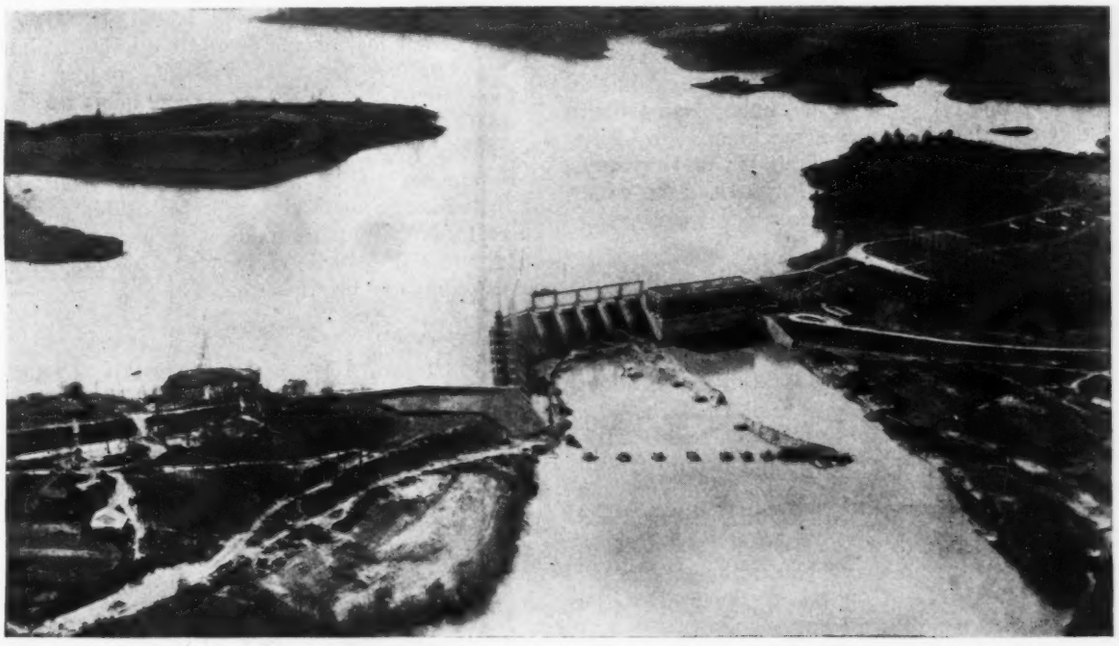
"Active spindle-hours for 1927 in North Carolina alone amounted to 23,659,238,612—exactly 1,556,481,127 more active spindle-hours than any other state in America. And South Carolina was close behind with 22,102,757,485 active spindle-hours."

Typical furniture-industry advertising placed by the Duke company declares that "From the largest stand of hardwood east of the Rockies, Piedmont Carolinas has built up a furniture industry whose production already exceeds $60,000,000 a year. In each of 29 Piedmont Carolina towns there is a manufacturing nucleus producing more than $100,000 worth of furniture annually, and such towns as High Point, Winston-Salem, Thomasville, Hickory, Lexington, Mount Airy and Lenoir range in annual volume from $2,000,000 to $20,000,000. At High Point, in a splendid ten-story building constructed for the purpose, the Southern Furniture Association holds markets every January and July (similar to those held in New York, Grand Rapids and Chicago), and more than 2,500 retail store buyers visit this market twice a year."

To deliver its interesting messages to potential power customers the Duke Power Company places similar full-page advertisements in *World's Work, Review of Reviews, Time, Nation's Business, Textile World, Southern Textile Bulletin* and the *Manufacturers' Record*. It uses frequent space also in the *Saturday Evening Post*, and in addition to this year-round magazine advertising it uses space two or three times each week in the *Wall Street Journal*, Boston *News Bureau* and Chicago *Journal of Commerce*.

That these activities of the Duke company are proving effective is indicated by the fact that new industrial plants attracted to its territory during the past four months include, among others, a tinfoil plant at Winston-Salem (home of Camel cigarettes), a fruit and vegetable cannery at Henderson, a box and container factory at High Point, a silk mill at Greensboro, a boat works at Hickory, a machinery branch at Spartanburg, a hosiery mill at Bellmont, a weave room at Drayton Mills, a button factory at Mount Airy, a sash-and-door mill at Charlotte, an overall plant at Hickory, a furniture factory at Elkin, an underwear plant at Thomasville, a bag mill at Greenville and a fiber factory at Spartanburg.

Obviously, each new mill or factory that comes to Piedmont Carolinas is a prospective customer for the Duke company's power. But the Duke Power Company is not interested solely in new customers for its product.



Catawba Hydro-Electric Station of the Duke Power Company as It Looks to Aviators

This 80,000-hp. plant was literally built over the original plant of the Duke system, a 10,000-hp. plant completed in 1904

It is interested also in developing its present customers into bigger and better customers.

It knows that every factory secured brings in new wage earners and new purchasing power for the older factories already operating. Its surveys showed that its territory is fairly dotted with big customers who a few years ago were comparatively little customers—factories relatively unimportant yesterday, but today modern industrial plants with major power requirements.

In the belief that anything which is good for the community is good for the company's 44 power stations, the Duke company rejoices almost as much over bringing in new capital, new wholesale houses and new branch offices (which use very little if any power except light) as in obtaining a mammoth rayon plant or a giant cotton mill.

Per Capita Wealth Through Use of Power

Industrial-minded America knows that as the horsepower per workman increases prosperity increases. When we rank the leading countries of the world in the order of their industrial strength we have ranked them in the order of their horsepower per workman. In China it is 0.12; in Italy, 0.31; in France, 0.97; in Germany, 1.5; in England, 2.4; total United States, 3.6; while in Piedmont Carolinas the horsepower per workman is 4.25!

"Does that explain why per capita wealth is increasing in Piedmont Carolinas three times as fast as in many other states?" succinctly asks Duke advertising, and adds: "Increase in Piedmont Carolinas' electrical power consumption of 1927 over 1926 was 20.5 per cent, as against the nation's increase of 6 per cent."

Starting with a single 10,000-hp. plant near Rock Hill, S. C., in 1905, the Duke Power Company has developed the water-power resources of the Catawba River and now has plants on the Broad, Yadkin, Saluda, Seneca and other rivers. So intensively is the natural fall of these rivers being utilized that in many places the tailrace of one plant flows practically at once into the head of the "pond" for the plant next lower down the river.

The company's water-power plants generate a total hydro capacity of 713,200 hp., while its steam-power plants provide a total capacity of 240,000 hp., a grand total of 953,200 hp. Moreover, plants now under construction will soon bring this total capacity to 1,103,200 hp.

An idea of Piedmont Carolinas' wealth of natural energy may be had from the conservative estimate that if this region had to purchase annually the fuel to generate the electric current now created by water power it would have to pay coal-producing states and transportation lines more than $7,500,000 every year (with coal at $2 per ton at the mines). This mammoth coal pile would cover 1½ acres and rise up 300 ft. above the Woolworth Building tower. To transport it would require a train more than 400 miles long—a continuous string of coal cars stretching from Pittsburgh through New York and all the way to Boston.

A Monument to James B. Duke

The Duke Power Company, and the tremendous industrial development of Piedmont Carolinas, is a monument to the energy and far-seeing vision of James B. Duke, founder of the American Tobacco Company, whose products are smoked the world over. He estimated the potentialities of the region, the fiber of its men and women, the fortune-building opportunities it offered to industry.

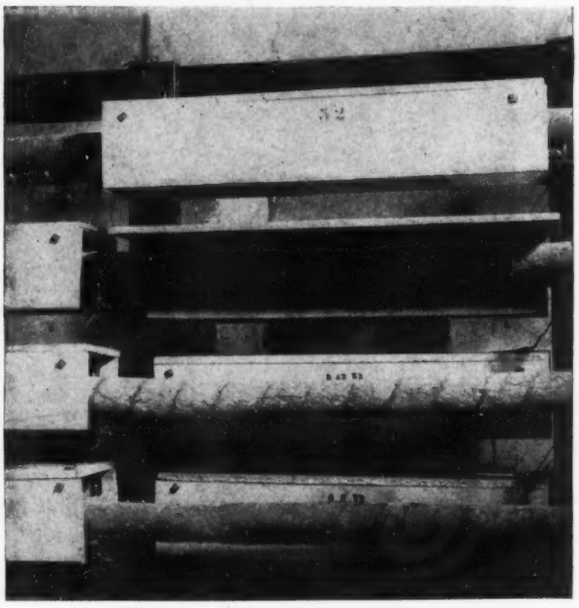
He foresaw how they all would be affected by the harnessing of the region's vast water power and by the creation of an enormous hydro-electric development. His appraisal of these potential values cannot be summed up better than by his own words in the indenture by which he established the Duke Endowment:

> For many years I have been engaged in the development of water powers in certain sections of the states of North Carolina and South Carolina. In my study of the subject I have observed how such utilization of a natural resource, which would otherwise run in waste to the sea . . . both gives impetus to industrial life and provides a safe and enduring investment for capital. My ambition is that the revenues of such development shall administer to the social welfare, as the operation of such development is administering to the economic welfare of the communities which they serve.

In order to give force to his desire that the hydro-electric system he planned and started to build should create social values as well as industrial values, he ordained that the income from its operation should go to various charities and to the building up and extension of the supporting water-power development itself, "so that it shall be adequate to meet the growing needs both of industry and of those social agencies which depend upon it."

Because of J. B. Duke's far-seeing vision and because of the scientific methods employed by his successors, the Duke Power Company today is an example of successful merchandising which might well be emulated by every power company in America.

Minimizing Cable Joint Hazard



WHENEVER a number of cable joints occur in an underground pit or are located near other cables it is the custom of the city of Winnipeg Hydro-Electric System to provide shields around the joints, according to T. A. Robinson. The shields are constructed from ½-in. asbestos board, fastened together small strap-iron angles attached with $\frac{3}{16}$-in. x 1-in. bolts. These barriers are hung, free from the joint, by wires from the cable-supporting brackets and cover the joint on the top and two sides. If there is not a similar shield below, then a flat piece of board is suspended underneath, so that all joints are completely incased in asbestos. These shields will effectively stop the spread of cable trouble, according to Mr. Robinson.

Street Lighting Costs for 1928

By Otto P. Ortlieb
Engineer of Street Lighting, Trenton, N. J.

A STUDY of street lighting costs which has just been completed shows that the average street lighting expenditure throughout the United States was $1.10 per capita during 1928. This study covered 224 cities above 30,000 in population. There are 30 other cities in this class which did not return the information requested. The 224 cities which did make returns included an estimated population of 42,658,286 in 1928. This was 94 per cent of the total estimated population in all cities above 30,000. The total expenditure for street lighting during 1928 of the 224 cities reporting was $46,938,726.

During 1923 212 cities reported an average expenditure of $0.896 per capita. In other words, the average per capita cost of street lighting in the cities throughout the country has increased an average of 4.2 per cent each year during the past five years. If it is assumed that this represents the actual increase each year, the per capita costs in the intervening years can be estimated as follows: 1923, $0.896 per capita; 1924, $0.934 per capita; 1925, $0.973 per capita; 1926, $1.014 per capita; 1927, $1.056 per capita; 1928, $1.10 per capita.

Reports from the 224 cities previously mentioned indicate that eleven cities are planning a large increase, 89 a moderate increase, 76 a small increase and eleven are not planning any change.

The questionnaires sent out were addressed to the city officials in charge of street lighting. It was requested that the costs reported include the charges of the operating company or the costs of the municipal system, the administrative costs such as salaries, and also the interest and sinking fund requirements on any outstanding city bonds issued for street lighting purposes.

In some cities the installation cost of a new system may be paid in one year and costs in following years will not show this improvement, while in the case of a city paying a utility company for street lighting a part of the installation cost is usually included in the yearly rates as long as the lamps are in service. In some cases the cost of the street lighting, or some part of it, is borne directly by the property owners along certain streets, and this cost might not be included in the city report. Where cities have municipal systems it is sometimes difficult properly to allocate all the depreciation and

Cities Which Spent More than $1 per Capita for Street Lighting in 1928

	Estimated 1928 Population	Total 1928 Cost	1928 Cost per Capita	1923 to 1928 Average Annual Increase in Cost per Capita, Per Cent	Future Increase Planned
Chicago, Ill.	3,157,400	$4,268,000	$1.352	5.3	Small
Philadelphia, Pa.	2,064,200	3,289,709	1.594	5.8	.....
Los Angeles, Cal.	1,500,000	2,393,222	1.595	.....	Moderate
Cleveland, Ohio.	1,010,300	1,065,541	1.055	6.9	Moderate
St. Louis, Mo.	848,100	1,134,843	1.338	1.6	Moderate
Baltimore, Md.	830,400	1,380,007	1.662	1.5	Moderate
Boston, Mass.	799,200	977,196	1.223	4.7	Moderate
Pittsburgh, Pa.	676,600	829,376	1.226	0.4	Moderate
Buffalo, N. Y.	555,800	1,072,568	1.930	10.9	Moderate
Washington, D. C.	502,000	968,790	1.755	14.0	.....
Milwaukee, Wis.	.....	.....	.....	.....	.....
Newark, N. J.	473,600	490,000	1.035	5.2	.....
Cincinnati, Ohio.	425,000	557,000	1.311	.....	Small
Kansas City, Mo.	391,000	600,000	1.535	3.3	Small
Rochester, N. Y.	340,000	733,550	2.157	9.8	.....
Toledo, Ohio.	313,200	352,200	1.125	5.2	Moderate
St. Paul, Minn.	250,666	314,368	1.254	—0.5	Small
Worcester, Mass.	206,000	290,500	1.410	2.5	Small
Syracuse, N. Y.	199,300	296,095	1.486	13.2	Moderate
Miami, Fla.	156,700	274,813	1.754	13.2	Small
Long Beach, Calif.	155,000	167,749	1.082	12.2	Moderate
Des Moines, Iowa.	151,900	229,470	1.511	2.4	.....
Springfield, Mass.	149,800	227,042	1.516	5.4	Moderate
Albany, N. Y.	140,000	249,000	1.779	8.4	Large
San Diego, Calif.	140,000	213,462	1.525	11.0	Moderate
Trenton, N. J.	139,000	224,105	1.612	11.7	Moderate
Camden, N. J.	135,400	151,876	1.122	3.5	Small
Cambridge, Mass.	125,000	137,077	1.097	8.1	Large
Fall River, Mass.	124,308	133,834	1.077	1.1	None
Yonkers, N. Y.	121,300	273,886	2.258	5.0	Moderate
Canton, Ohio.	116,800	150,000	1.284	1.5	Moderate
Tampa, Fla.	113,400	166,303	1.467	6.4	Small
Lynn, Mass.	109,706	136,129	1.241	13.3	Small
Utica, N. Y.	104,200	162,283	1.557	10.9	Moderate
Lowell, Mass.	100,000	153,147	1.531	4.6	Small
South Bend, Ind.	100,000	105,000	1.050	3.6	Moderate
Bayonne, N. J.	95,300	110,000	1.154	.....	.....
Schenectady, N. Y.	93,300	202,707	2.173	10.9	Large
Lawrence, Mass.	90,000	121,478	1.350	12.8	.....
Pasadena, Calif.	85,000	99,962	1.176	2.3	Moderate
Fresno, Calif.	83,000	84,000	1.012	—4.4	Moderate
Shreveport, La.	81,300	86,000	1.058	7.6	Small
Lansing, Mich.	79,600	81,535	1.024	8.0	Moderate
Portland, Maine.	78,600	118,000	1.501	—0.1	Small
Manchester, N. H.	76,651	83,595	1.091	6.9	Moderate
Binghamton, N. Y.	74,800	90,834	1.214	9.8	Moderate
Racine, Wis.	74,400	87,859	1.181	2.6	.....
Troy, N. Y.	72,300	97,428	1.348	2.5	Small
Lincoln, Neb.	71,100	73,743	1.037	—0.6	Small
Covington, Ky.	69,700	80,188	1.150	.....	Moderate
Niagara Falls, N. Y.	68,300	92,036	1.348	7.7	.....
Oak Park, Ill.	68,000	70,688	1.040	12.7	Small
Quincy, Mass.	67,600	85,290	1.262	7.1	.....
East Orange, N. J.	65,000	89,575	1.378	8.3	.....
Brockton, Mass.	63,787	88,268	1.384	7.0	Moderate
Davenport, Iowa.	61,000	85,400	1.400	4.2	Small
Atlantic City, N. J.	60,000	204,000	3.400	2.7	Small
Kenosha, Wis.	59,000	69,500	1.178	2.5	Moderate
Lancaster, Pa.	58,300	67,000	1.149	—1.0	.....
Newton, Mass.	58,245	115,693	1.986	4.4	Moderate
Stockton, Calif.	58,000	78,042	1.346	3.0	Moderate
Augusta, Ga.	56,700	56,868	1.003	0.9	Small
Hammond, Ind.	56,000	60,073	1.073	5.1	.....
Pueblo, Colo.	55,000	79,000	1.436	.....	.....
York, Pa.	55,000	59,110	1.075	4.8	Small
Mount Vernon, N. Y.	54,700	111,846	2.045	14.7	Moderate
Malden, Mass.	53,400	56,216	1.053	3.5	Moderate
St. Petersburg, Fla.	53,300	88,470	1.660	5.9	None
New Castle, Pa.	52,500	75,891	1.446	15.0	None
Perth Amboy, N. J.	50,100	52,000	1.038	—1.3	Moderate
Haverhill, Mass.	50,000	50,798	1.016	2.7	Moderate
Jamestown, N. Y.	50,000	58,789	1.176	0.0	Small
New Rochelle, N. Y.	50,000	142,457	2.849	12.9	Large
Pittsfield, Mass.	50,000	76,640	1.533	5.3	Small
Brookline, Mass.	45,700	83,884	1.835	—1.4	Small
Fitchburg, Mass.	45,200	67,013	1.483	4.6	Small
Stamford, Conn.	43,800	62,357	1.424	0.8	Moderate
Butte, Mont.	.....	.....	.....	.....	.....
Everett, Mass.	43,300	54,145	1.250	10.2	Moderate
Salem, Mass.	43,000	56,165	1.306	6.6	Small
Dubuque, Iowa.	42,300	56,873	1.345	0.5	Small
Poughkeepsie, N. Y.	41,000	57,764	1.409	3.5	Moderate
New Brunswick, N. J.	40,800	55,000	1.348	1.6	None
Waltham, Mass.	40,000	43,500	1.087	0.5	Moderate
Waterloo, Iowa.	40,000	40,821	1.025	0.7	.....
Auburn, N. Y.	39,800	46,881	1.178	—14.7	.....
Amarillo, Texas.	39,200	39,837	1.016	—4.7	Moderate
Hazleton, Pa.	38,300	39,400	1.029	7.9	Small
Colorado Springs, Colo.	37,000	45,089	1.219	2.3	Small
Orange, N. J.	36,500	42,614	1.168	2.0	None
Amsterdam, N. Y.	36,200	59,000	1.630	9.7	None
Green Bay, Wis.	36,100	43,456	1.204	7.2	Small
Moline, Ill.	35,600	39,763	1.117	7.3	Small
Watertown, N. Y.	33,700	50,000	1.484	.....	.....
La Crosse, Wis.	30,400	33,850	1.113	6.8	Small
Newburgh, N. Y.	30,400	45,517	1.497	5.2	Moderate

Summary of 1928 Street Lighting Costs

	Estimated 1928 Population	Total 1928 Cost	1928 Cost per Capita	1923 to 1928 Average Annual Increase in Cost per Capita, Per Cent
38 cities above 200,000	28,095,653	$32,251,589	$1.148	4.3
47 cities between 100,000 and 200,000	6,367,015	6,521,856	1.024	5.0
39 cities between 70,000 and 100,000	3,158,999	2,890,188	0.915	2.9
56 cities between 50,000 and 70,000	3,261,386	3,421,526	1.049	3.3
44 cities between 30,000 and 50,000	1,775,233	1,853,567	1.044	2.7
224 cities	42,658,286	$46,938,726	$1.100	4.2

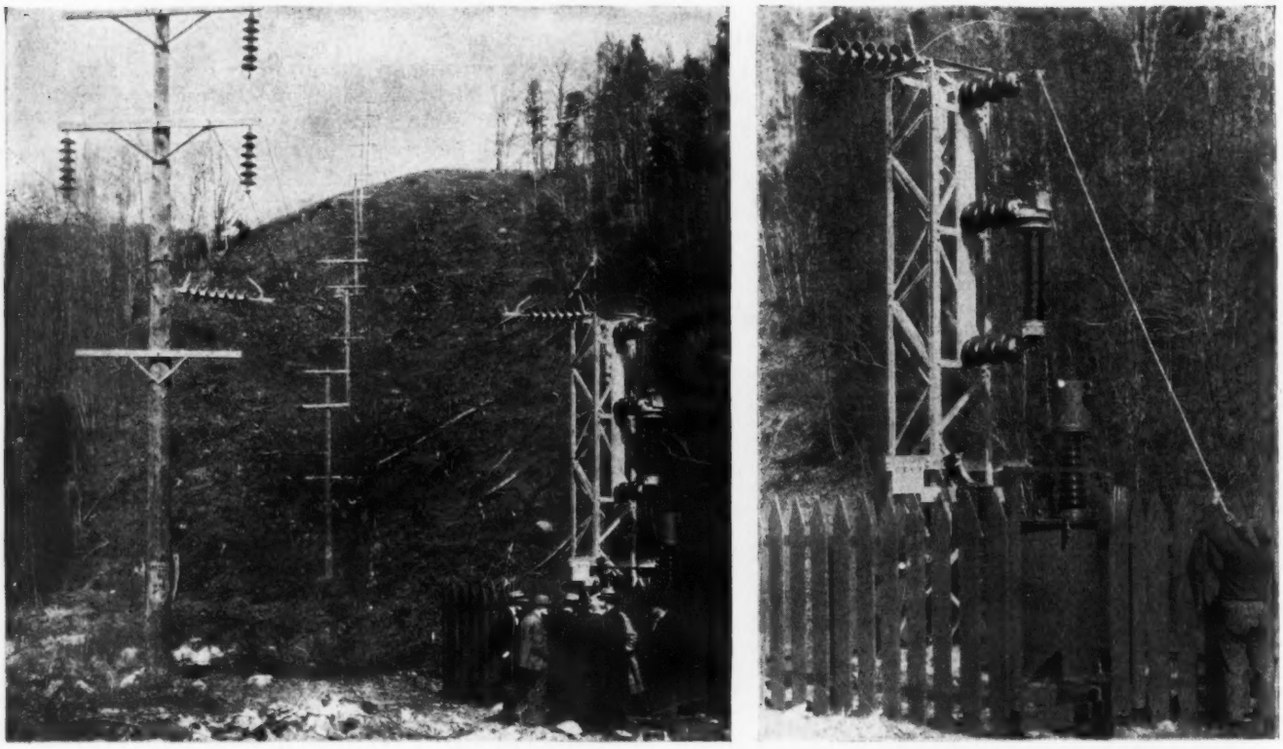
interest charges and this might cause some variation. Some cities have a fiscal year differing from the calendar year and in such cases the cost reported might be for a somewhat earlier twelve-month period.

Since practically all of the foregoing variations mentioned would tend to indicate a lower cost than is actually the case, it may be assumed that the average per capita cost is possibly slightly higher than it is here reported.

Ten cities report that they will make large expenditures for street lighting in the near future, Albany, Cambridge, Schenectady, New Rochelle, Detroit, Flint, Duluth, Mobile, Cedar Rapids and Muskogee. In addition to the cities listed in the accompanying table 49 cities plan a moderate expenditure.

Rural Substation Tapped to 66-Kv. Line

By L. H. PERRY
Central Station Engineering Department, General Electric Company



Rural Substation Connected Between 66-Kv. Line and Grounded Neutral to Supply 50-Kva., 2,300-Volt Service

THE problem of supplying scattered rural central-station loads economically, direct from high-voltage transmission lines, has been, it is believed, solved by equipment which has been developed by the General Electric Company. The expense of conventional methods of accomplishing this service is often prohibitive, as the simplest distribution line from a distant substation costs from $1,500 to $2,000 per mile, and even with the load adjacent to a high-voltage transmission line the cost of a conventional substation could seldom be justified.

The newly developed equipment consists of a complete single-phase, small-capacity (15- to 50-kva.) substation for use on 66,000-volt grounded-neutral systems, in which several of the expensive parts of the conventional substation have been eliminated without sacrificing safety or reliability. With this equipment public utilities can reach a field heretofore untouched. After developing the load, a larger station can be installed or an existing distribution system extended from a distant point, freeing the small station for a new location and a repetition of the load-building process.

The insulation throughout the substation is so designed that its strength against lightning voltages is greater than the strength of the high-voltage line itself. Thus the line protects the station.

For the conventional oil circuit breaker, relays, current transformer and disconnecting switch there is substituted a combined disconnecting switch, fusible cutout and current-limiting resistor unit. This high-speed interrupting device will protect the high-voltage line against interruption because of faults in the step-down transformer, substation structure or distribution lines.

The substation is designed for connection between one phase and the grounded neutral on a line that is solidly and permanently grounded at every power source. The line preferably should carry an overhead ground wire,

grounded at intervals along the line. The substation may not be applied to a system where the neutral ground connection can be lost even momentarily, which would in effect give a delta system with a floating neutral.

Equipment for the new small-capacity, high-voltage substation for rural service includes the following:

A single-phase oil-insulated, self-cooled outdoor type transformer, rated 60 cycles, 15, 25 or 50 kva., high voltage 38,100/66,000-Y with one end of the winding permanently grounded, low voltage 2,300/2,530.

A galvanized steel structure, completely fabricated, and shipped disassembled, with each piece properly marked to facilitate erection.

An outdoor current-limiting resistor mounted with a combined disconnecting switch and 73-kv. fusible cutout.

A complete single-phase, 2,300-volt metering equipment.

2,300-volt cutouts and lightning arrester.

A set of installation material, including connector fitting, bus supports, high- and low-voltage strain insulators, copper interconnections, ground bus, etc.

The substation is designed on the principle that the high-voltage line is an all-important artery and that its continuity in service must be maintained. With this in mind, the various parts of the station—the transformer, high-voltage fuse and resistor unit, strain insulators and low-voltage fuse—must be designed and matched so that the station will not affect the operation of the high-voltage line because of transient overvoltages, overloads or short circuits. The successful operation of this substation depends upon its co-ordinated design, and therefore there can be no substitution of individual parts.

Overvoltage Protection

All the insulation on the high-voltage side, including strain insulators, post insulators, transformer bushing and transformer winding insulation, is designed to withstand higher lightning and surge voltage than will the high-voltage line insulation. To obtain this, more disks are used in the strain insulators than in the line, and the post insulators and the transformer bushing are of a higher voltage class. Furthermore, the impulse breakdown of the transformer insulation is made higher than that of the transformer bushing, so that the bushing will flash over and protect the windings. The line itself thus provides lightning voltage protection for the substation.

One end of the high-voltage winding of the transformer is brought out through an oil-filled bushing; the other end of the high-voltage winding is permanently and solidly grounded to the tank, and provision is made for solidly grounding the tank. The low-voltage winding is provided with a 10 per cent full kilovolt-ampere capacity tap above 2,300 volts. Three low-voltage cover bushings are furnished.

The transformer core is of non-aging silicon steel and the turns of the windings are proportioned for low core flux density and low exciting current. The harmonic components of the magnetizing current are reduced to a minimum so as to preclude the possibility of telephone interference from the ground current flowing back to the system neutral.

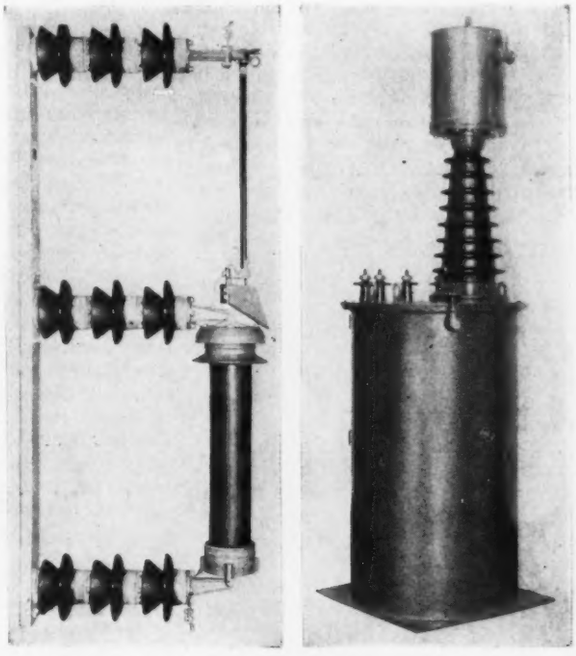
High-Voltage Fuse and Resistor

The 73-kv. high-voltage combined disconnecting switch and fusible cutout is supplied with the new spring release fuse. The series resistor limits the maximum short circuit and keeps the arc kilovolt-ampere well within the interrupting ability of the fuse, which acts so quickly that a fault in the substation cannot draw current for a sufficient length of time to cause the system relays to function. The fault current ordinarily is limited to much less than the load current of the high-voltage line.

Exhaustive tests have shown that this fuse-resistor combination will satisfactorily interrupt current ranging from short-circuit value down to approximately the lowest melting current of the fuse. Inability of previously available high-voltage fuses to provide satisfactory interruption over this wide range has beeen the reason why they have not been used heretofore as circuit-interrupting devices.

The fuse may be used as a disconnecting switch to break the magnetizing current of the transformer. The operators should open the low-tension circuits, thus removing the power load, before attempting to disconnect the high-voltage fuse.

The current-limiting resistor is designed to carry full-load current continuously, to carry fault current without an arc over, to be free from corona, to be weatherproof



Equipment for Small-Capacity, High-Voltage Substation

Includes expulsion fusible cutout, disconnecting switch, current-limiting resistor and 38,100/66,000-volt to 2,300/2,530-volt transformer.

and to be free from injury resulting from overvoltage on the high-voltage line caused by lightning or switching surges. It will carry current resulting from a dead short circuit across the resistor with leg voltage sustained, without injury to the resistor, for a time somewhat in excess of the time required by the high-voltage fuse to interrupt the circuit.

Low-Voltage Cutouts

The low-voltage cutouts are rated 5,000 volts and are provided with suitable fuses. A cutout is supplied for each low-voltage lead and serves not only as a fuse but also as a disconnecting switch. The 2,300-volt, single-phase side shall be dead-grounded as recommended by the company.

The low-voltage fuses are selected to clear any fault on the 2,300-volt distribution line before the high-voltage fuses can melt, therefore leaving the latter to clear only faults occurring within the transformer or other parts of the substation as a protection to the high-voltage line. As the time-current characteristics are matched, fused ratings must not be changed.

Digest of Electrical Literature

Hydro-Electric Development and Steam Equipment

Modern Coal-Burning Methods.—WILLIAM D. WYLDE.—A comparison of pulverized fuel and stoker firing for purposes of steam generation has been undertaken to determine the most economical system. In discussing the factors involved the author has considered that, apart from coal dust inflammability and explosive propensities, this element is controlled by the speed of injection, the weight of combustible per unit weight of coal, the volatile content, the size of the coal particles, the ash content per unit weight of coal and the extent to which the coal and air are mixed prior to leaving the burner. A thorough evaluation of the several factors involved has been made and the conclusion reached that providing one does not take the criteria of the ideal method of burning raw coal as being the number of B.t.u. liberated per cubic foot of furnace volume per hour, which after all is not exclusively the deciding factor in steam production efficiency, he is left with the microscopic difference in the thermal efficiency obtainable from the two methods of firing remaining, as hitherto, the only loophole for those who wish to be ultra-controversial in matters concerning the economical production of steam.—*Electrical Review (England)*, May 3, 1929.

Transmission, Substations and Distribution

Tying of Networks.—B. JANSEN.—Electrical and economical advantages may only be expected from the coupling of two or more power systems, when precautions are taken to eliminate or to overcome certain concurrent phenomena which either do not exist or are of secondary importance for an isolated station, premises the author. The three outstanding difficulties are the compensation of wattless current, proper voltage regulation and the limitation of short-circuit current. This discussion deals at length, but only in a general way, with the second and third problem. It is shown how load ratio control transformers can be advantageously used to tie stations to one system. The author points out that American practice was quick to realize the great value of such transformers, which is best illustrated by the fact that 40 per cent of American transformer orders cover such machines. By a slight modification, voltage regulation can be combined with phase-angle regulation, in which case a stationary transformer with proper switching equipment, limited at present to about 1,000 amp., can compete with a rotary phase shifter or condenser. — *Elektrotechnische Zeitschrift*, April 11, 1929.

Reflection of Transmission-Line Surges at a Terminal Impedance.—O. BRUNE.—Traveling waves on a transmission line have always been a subject of absorbing interest and in the past have received the attention of many leading engineers. An absolutely correct and complete theoretical treatment of the subject leads into almost insuperable mathematical difficulties. For this reason most of the early work was confined to greatly simplified cases, such as the non-dissipative line and waves of rectangular wave shape. Although much good work of this character has been done, progress is bound to be slow. The lack of testing means for studying these phenomena in detail further hampered progress. The cathode ray has provided a means of obtaining first-hand evidence as to the correctness of such theories and the closeness of approximations. The calculations for certain cases of reflection of non-rectangular surges on a transmission line at a terminal impedance are presented. Oscillograms obtained on an actual transmission line under conditions similar to those assumed in the calculations are also shown and the agreement is found to be very close.—*General Electric Review*, May, 1929.

Units, Measurements and Instruments

A Braun Tube Hysteresigraph.—J. B. JOHNSON.—A description of the apparatus for observing hysteresis loops of magnetic materials. It combines a cathode-ray oscillograph with a vacuum tube amplifier and an electrical integrating circuit consisting of condenser and resistance. The device describes the B-H curve for alternating magnetization in the frequency range of five to perhaps several thousand periods per second. The specimens may be either long strips or closed rings. Alternating flux as low as one maxwell may be readily observed. The operation of the apparatus is analyzed so as to account for the effects of finite time constants of the amplifier and integrator, of conductance in the condensers, of demagnetization by current in the search coil and by the stray fields of coils and specimen, and of eddy currents in the specimen.—*Bell System Technical Journal*, April, 1929.

Generation, Control, Switching and Protection

Electricity Supply in Worcester.—A comparatively small size steam-generating station utilizing powdered coal, water-wall tube screens, air-cooled walls and floor, and involving unusually high boiler performance factors is described. This station is devoted largely to the supply of Worcester and the surrounding rural districts and special provisions have been utilized to serve this type of load.—*Electrical Review (England)*, May 10, 1929.

Automatic Reclosing of High-Voltage Circuits.—E. W. ROBINSON and S. J. STURGEON.—The experience of the Alabama Power Company with the reclosing of high-voltage circuits is described, this covering numerous installations on 22-, 44- and 110-kv. circuits. No definite reclosing cycles are recommended, but instead this paper deals with various typical applications of high-voltage reclosing oil circuit breakers on the Alabama Power Company's system.—*Report American Institute of Electrical Engineers*, May, 1929.

Illumination

From 2 to 50 Ft.-Candles Increase in Factory Lighting.—CHARLES PRYAL, SR.—A forward step in factory lighting was taken in changing over the Jantzen Knitting Mills, Portland, from low-intensity, local lighting to high-intensity, general lighting. It is too soon to secure data that might indicate some of the dollar and cents returns secured by the Jantzen company, but it is quite evident that the benefit to the eyes of the workers with its attendant psychological effect will render a higher overall plant efficiency through the bettering of the morale of the operators.—*Electrical West*, May 1, 1929.

Electrophysics, Electrochemistry and Batteries

The Paramagnetic Susceptibility of Pentavalent Vanadium Ion. — NICOLAS PERRAKIS.—The paramagnetic susceptibility of the pentavalent vanadium ion was investigated. Two grades of V_2O_5 were tested and also the salts NH_4VO_3 and $NaVO_3$. Both the ascension and attraction methods were employed. An average value of 44×10^{-6} correct within 10 per cent was found for the susceptibility of V^v. This value is appreciably lower than the value Honda and Owen obtained for metallic vanadium, but since this difference cannot be ascribed to errors in experimentation, it seems safe to conclude that an element may have several different values for the magnetic susceptibility. The importance and need of further study of this important subject is emphasized. — *Report the American Electrochemical Society*, May, 1929.

The Electroplating of Cadmium from Cyanide Baths.—L. R. WESTBROOK.—The cyanide bath for commercial cadmium plating is discussed in detail from the standpoint of bath composition, including the effects of variations in the

concentrations of the different constituents on the electrical properties of the bath, such as cathode efficiency, conductivity, throwing power, electrode polarization, anode corrosion and operating range of cathode current densities for satisfactory deposits. The effects of the presence of small amounts of other metals in the bath are considered, especially the marked improvement in the physical characteristics of the deposit resulting from the presence of a few hundredths of a per cent of nickel or larger amounts of cobalt or copper in the bath. The organic addition agents which function best with these baths are listed and formulas for typical baths are given.—*Report the American Electrochemical Society,* May, 1929.

Traction

Electric Traction in Italy.—L. VELLARD.—At the end of 1928 there were a total of 1,300 miles of electrified roads in the country. Unlike other European countries, Italy is far from having adopted a uniform current supply system, although the three-phase type of locomotives dominates any other type. There are now four classes of electric locomotives used extensively: Three phase, 3,000 volts and 15 cycles; three phase 10,000 volts and 45 cycles; direct current, 3,000 volts, and, finally, direct current, 650 volts. The second class is the most widely used and will perhaps gradually supersede all others. The engines of this class have rotor-wound, three-phase induction motors, the stators of which can be changed from eight to twelve poles. Cascade connection and change of poles gives these engines economical speeds of 23, 31, 46 and 61 m.p.h. There are now over 600 electric locomotives in operation.—*Revue Générale de l'Electricité,* March 16, 23 and 30, 1929.

Miscellaneous

Electric Supply of Norway.—ERIK FINNE.—According to the latest power census, Norway has 500,000 kw. installed electric generator capacity, all of which is water power. Of the 2,700,000 inhabitants, 70 per cent are consumers of light and power, which gives, prorated for the whole country, 200 watts per inhabitant. Due to the wide popularity of electric cooking and heating, the annual duration of average use is between 5,000 and 6,000 hours, which is claimed to be a world record. Practically all energy is sold on a flat rate rate basis at 180 kr. per kilowatt year, with current limiting devices at each customer. The northern location of the country requires an average of 1,200 hours artificial illumination per year, and the house heating period is a minimum of six months, with three months of auxiliary fall and spring heating. A detailed account is given of the supply of Oslo, the capital, which consumes alone about 110,000 kw., derived from four generating stations near by.—*Elektrotechnische Zeitschrift,* April 18, 1929.

Book Reviews

Electrical Substations

By H. Brazil. London: Edward Arnold & Company. 215 pages, illustrated. Price, $5.

Substation design and equipment as developed in England is dealt with in this book. The author has spent many years in London distribution engineering and draws upon his personal experience. English equipments and designs differ largely from those used in the United States, but engineers can well afford to read of different practices in order to check their own and to develop new ideas. A striking feature of English substation practice is the use of motor-converters, iron-clad switchgear and unusual methods of regulation. Loads and load density are not of the magnitude found in American cities, but the same principles apply and equipment is developed to meet parallel conditions.

The book is descriptive, contains fundamental principles on layout and design and describes apparatus, methods of operation, relays, regulators and other elements of substation engineering. It is an instructive and practical book, even though many engineers will disagree with suggested layouts and assemblies. More economic analyses of relative cost of different assemblies would have added greatly to the value of the material.

Elementary Differential Equations

By T. C. Fry. New York: D. Van Nostrand Company, Inc. 255 pages. Price, $2.50.

Engineers are apt to shy at differential equations, but in this text the author has developed the subject clearly and logically. It is a text based on teaching engineers of the Bell system and thus the illustrative material for the application of the pure mathematics is drawn largely from electrical sources. This text can be recommended highly to those desiring to get a sound grasp of differential equations and their applications.

Maste und Türme in Stahl

By P. Sturzenegger, Zürich. Berlin: Wilhelm Ernst & Sohn. 219 pages. 362 illustrations.

This publisher started several years ago a set of books covering the wide range of modern engineering structures of steel, such as bridges, halls, roofs, cranes, vessels, etc., each subject treated in a separate book of the collection. The extended and constantly growing use of steel for the construction of transmission, railway and radio towers prompted the publication of this additional book. In it the author gives first the fundamentals of the arrangement of the electric wires on the towers for transmission lines, railway overhead lines and antennas, following which is the main chapter on calculation, design and foundation of the structure. Depending upon voltage, span and stresses, a great variety of constructions is given, with scale drawings and photographs. Novel and little known shapes will be found in the book, suitable for lines up to 380 kv., such as are planned for a German 250-mile line. A special chapter is devoted to towers for electric railways. Foundations, rust protection, erection, maintenance and cost figures conclude the original book.

Television

By H. Horton Sheldon and E. N. Grisewold. New York: D. Van Nostrand Company, Inc. 194 pages; illustrated. Price, $2.75.

This is an attempt to give a clear picture of the state of television today in order to make possible further study of any special features. The authors realize the rapid development of the art and confine the book to essential considerations. All modern systems are described, and as a fundamental background chapters are devoted to electromagnetic waves, optical systems and the eye, photoelectric cells, oscillograms, synchronization, relays and other technical features. A splendid chapter deals with the essential elements of television and another covers the historical background.

This is a non-technical treatise in the sense of a maximum use of mathematics and has good style. It is a book any engineer and specialist can enjoy reading and the non-technical man can grasp the essential ideas. A very delightful chapter deals with the future of television. The authors do not predict the future, but they point out trends and possibilities.

Book Notes

THE "ELECTRICIAN." Annual Tables of Electricity Undertakings, 1929. London: Ernest Benn, Limited. Price, 10 shillings.

The forty-second edition of the "Electrician" Annual Tables of Electricity Undertakings is now out. Particulars of about 800 British and 1,300 colonial and foreign electric light and power undertakings are included. Some of the countries covered are Great Britain, Australia, Canada, India, China, Africa and Spain.

Books Received

"Recent Economic Changes in the United States." Report of the Committee on Recent Economic Changes of the President's Conference on Unemployment. New York: McGraw-Hill Book Company. 2 Vols., 350 pages.

Siemens Jahrbuch, 1929. By Herausgegeben von der Siemens & Halske A.-G. Und der Siemens-Schuckertwerke A.-G. Berlin: V.D.I. Verlag G.M.B.H.

"Seven-Place Natural Trigonometrical Functions." By Howard Chapin Ives, C.E. New York: John Wiley & Sons, Inc. 222 pages. Price, $2.50.

News of the Industry

N.E.L.A. Tells of Payments to Professors

Federal Trade Commission Also Hears from the Director of the Smithsonian Institution and Again from A. R. Graustein of International Paper

NO WITNESSES were called when the Federal Trade Commission resumed its investigation of public utility companies on Wednesday of this week. Material submitted for the record included summaries of National Electric Light Association expenses, including payment to convention speakers and professors. To a list of 23 of the latter approximately $46,000 was paid from 1921 to 1928 for research and other work. This included expenses incurred in attending meetings.

Dr. C. G. Abbott, director of the Smithsonian Institution, said in a letter that there had been two editions of 10,000 copies each of the pamphlet written by S. S. Wyer which was published under the imprint of the institution. One edition was financed by the Duquesne Light Company of Pittsburgh and the other by the National Electric Light Association. Dr. Abbott asserted that only fifteen of the 1,147 publications of the Smithsonian in the past decade had been paid for by "outside parties."

Added details of the International Paper Company's newspaper transactions were given in a letter from A. R. Graustein. Mr. Graustein said that the investments of that company were not revealed to any utility firm, except that F. D. Comerford, in charge of the International's power interests, was notified. Mr. Graustein reiterated that the International Paper & Power Company was not concerned in the transactions in any way, the paper company and its associates being wholly responsible.

On Thursday Colonel Ire C. Copley, owner of newspapers in Illinois and California; W. J. Sylvester of the Industrial Conservation Board, Chicago, and Francis W. Collins of the Richmond Development Company, New York, were scheduled to appear; on Friday T. W. Martin and Logan Martin, officers of the Alabama Power Company, and Victor H. Hanson, publisher of the Birmingham *News*. J. F. McGowin, R. B. Chandler and E. F. Ladd of Mobile will be heard about June 19.

Early Hearings Not Likely on Communications Commission

Hearings before the interstate commerce committee of the Senate on the bill proposing the creation of a Communications Commission, which also is to have jurisdiction over the interstate transmission of power (ELECTRICAL WORLD, June 8, page 1208), have been suspended until the tariff bill shall have been reported out of committee. Indications are that no further hearings before the interstate commerce committee will be held until September or October.

Pacific Companies Resist New Investigation

Great Western Power Points to Supreme Court Decision and Attacks Commission's Valuation Methods—P. G. & E. Says It Will Take Time to Load New Equipment

WHEN the first hearing under the recent resolution of the California Railroad Commission ordering various utility companies in that state to show cause why the commission should not investigate their rates was held in San Francisco on June 10, the Pacific Gas & Electric Company and the Great Western Power Company of California took issue with the commission's method of arriving at the present rate base, fixed in 1923, and declared that this is a particularly inopportune time for any investigation of rates, because rate reductions made by the companies in the past year have not as yet been fully reflected.

With reference to appraisal of its properties for the fixing of rate of returns, the Great Western Power Company has let it be known that it stands on the principles laid down by the United States Supreme Court in the Indianapolis Water Company and other cases, to the effect that due consideration must be given to present-day reproduction costs. The company holds that the commission has used an incorrect basis for figuring land values in the past by taking an estimated cost basis instead of considering what the lands are worth, not necessarily for their present use, but for their highest valued use. A downward revision of the Great Western Power's lighting schedule in 1928 reduced revenues approximately $230,000 annually. Rates for agricultural power and for street and highway lighting also were reduced recently, in some cases as much as 10 per cent.

For the Pacific Gas & Electric Company it was argued that while facilities of the company are now loaded to capacity, this will not always be the case. The company will bring into service early in 1930 some $30,000,000 worth of new facilities, and it will take some time to load them up. While not fearful of a deficit in 1929, the situation next year might be very different.

Dion R. Holm, counsel for the city of San Francisco, suggested that the power companies should inform the commission as to what they consider a proper rate base.

Sale of Appliances Legal

Philadelphia Judge Refuses to Enjoin Utility from Merchandising and Says Right to Sell Energy Carries with It the Right in Dispute

DENIAL of the injunction asked by the Attorney General of Pennsylvania at the request of the Merchants & Evans Company, Philadelphia distributors of electric refrigerators, against the Philadelphia Electric Company, in order to prevent the latter from selling refrigerators and other appliances, was made by Judge Finletter in the Common Pleas Court of the city named on Thursday, June 6. The action, which had attracted much notice in electrical circles, was based on the contention that the electric company's charter restricted it to the sales of light, heat and power. The judge ruled that the right to sell electric appliances was a necessary adjunct of the right to sell electrical energy. He said in part:

The problem we face is the interpretation of the respondent's grant. This was that it be incorporated "for the purpose of supplying heat, light and power by electricity to the public." This grant was made in 1902, and the phrase used was no doubt intended to include in a general way all of the conveniences that could be produced by the use of the electric current. The relator's objections do not raise any question arising out of any particular use, but they dispute the right of the respondent to do anything more than supply electric current, and particularly they dispute its right to engage in merchandising the devices needed for converting electricity.

This interpretation, however, runs counter to the express language of the grant, which is not a power to "supply electricity," but certain things produced by electricity. Far from preventing the company from dealing in the converting devices needed, it would be our inclination to insist that it is part of its duty to furnish them to its customers. It is unimportant whether the converting device is supplied separately, by means of a sale or a bailing and a charge specially made for it, or whether the bill rendered the customer for the service includes also the use of the converting device. . . .

It is not wandering too far afield to point out—and it appears in the proofs—that in 1902 the industry in which the respondent was and still is engaged was comparatively new. The public had not been educated with regard to the multitude of conveniences which the electric current will supply. To furnish the housekeeper with the electric current alone would have resulted in neither profit to the company nor convenience to the customer. What the latter wanted, and what the Legislature intended to grant when it authorized the respondent to furnish light, heat and power by electricity, was something more than furnishing the customer with the end of an insulated copper wire that he did not know how to use or had not the appliances to use. It was intended that he should have and the company should furnish the conveniences.

Lower Basin States Still Fail to Agree

Delegates from California, Arizona and Nevada Thrash Over Their Difficulties Again at Washington—Los Angeles and Boulder Dam

NEGOTIATIONS toward a tri-state pact under the Colorado River agreement are now being carried on in Washington by representatives of California, Arizona and Nevada. Delegates from Colorado, New Mexico and Wyoming also are in attendance, although not directly concerned in the proceedings, which involve the division of the lower basin waters as allocated in the agreement. Although conditions may change before the conference is over, the present outlook seems to be that Arizona will seek a Supreme Court decision to determine her rights. Even so, it is not thought that such action would delay construction. The Boulder Canyon act does not become effective until the twenty-first of this month, and about a year's time probably will be taken in arranging contracts and other details preliminary to a work of such magnitude. By this time the Supreme Court could act and all legal difficulties presumably could be settled.

Present discussion hinges about the Gila River, which Arizona claims is not a part of the Colorado River system for purposes of the act because it joins the main stream close to the Mexican border below all contemplated diversion. Looking ahead fifty or a hundred years when the seven states are using their quota of allocated waters, if there is no surplus left for Mexico, some of the Mexican demand will have to be taken from the state apportionments. Arizona's contention is that to include the Gila in the system would deprive her of rights on the main stream if and when this shortage begins to be felt. In other words, Arizona claims exclusive right to the Gila and holds that such right shall not limit the share of water to be received from the Colorado River as divided in the agreement. No decision had been reached at the time of writing. It was suggested by Francis Wilson of New Mexico, acting as chairman, that such problems might well be deferred until they materialized, which might be never.

A proposed compromise was submitted quite early in the sessions, but the Arizona delegates apparently are maintaining their original stand. The proposal divides the waters allocated under the agreement, giving Nevada 300,000 acre-feet, California 4,600,000 and Arizona 3,600,000, a total of 8,500,000 acre-feet. This includes all present consumptive rights. The Gila problem is taken care of by providing that 1,700,000 acre-feet of Arizona's allotment shall be exempt from any future Mexican demand. All water remaining in the lower basin after satisfaction of the apportionments would be divided equally between California and Arizona. Machinery is set up for a further agreement after fifty years have elapsed.

A later proposal gives Arizona and California each 6,250,000 acre-feet and Nevada 300,000, the Gila and other Arizona tributaries to be included in these figures. Any additional Mexican burden would be shared jointly by Arizona and California. Involved in this apparently simple proposal is a great complexity of data. The proposed formula starts by deducting river losses, the Mexican burden and Nevada's 300,000 acre-feet to give the total quantity available for use. California gets half of this. Deducting the half from the 8,500,000 acre-feet apportioned to the lower basin by the act gives Arizona's share. Arizona also receives exclusive right to beneficial consumption on the Gila and other Arizona tributaries. The two states share and share alike any remaining surplus.

Colonel W. J. Donovan, chairman of the conference, has been striving to bring about a compromise through executive sessions attended by a limited number of delegates. One plan which was submitted made for the division by means of a formula which would vary from year to year according to the river flow. After extended discussion behind closed doors this was tabled.

At the close of Wednesday's session this week Colonel Donovan announced that he would draft a plan embodying the terms under discussion in their simplest possible form. This was to have been presented at the next meeting, Friday afternoon. Such an outline, it is pointed out, will give the delegates something tangible to consider during adjournment, which is expected by the end of the week.

Los Angeles and the Dam

The statement that the construction of Boulder Dam is assured because of the expressed readiness of the Los Angeles Bureau of Power and Light to purchase all the incidental power that may be generated is characterized as propaganda by members of Congress who opposed the passage of the act. They assert that the municipality will be obliged to spend $60,000,000 for the construction of transmission lines. This, they hold, it cannot do before it has put the matter up to the voters. They hold also that the bureau must obtain permission from the Calfiornia Legislature before it can increase its bonded debt by the amount necessary to purchase the power. Because of these conditions it is not believed that the Los Angeles bureau will be in a position to contract for the power by June 21. In this situation the government's legal advisers in all probability will refuse to let the contracts go through. Should an attempt be made to exert undue pressure on the governmental agencies involved, injunctive proceedings might be started in the federal courts.

Upstate New York Companies to Unite?

Buffalo, Niagara & Eastern, Northeastern Power, Mohawk-Hudson Power, Rockland and Central Hudson Asserted Ready to Merge Under Morgan Lead

PROGRESS toward the long-rumored coming merger of large New York State utility properties is probably indicated by an apparently informed story printed in the New York *Times* of Thursday, June 13. According to this account, negotiations for the consolidation of upstate groups with total assets of about $500,000,000 were virtually completed at the offices of J. P. Morgan & Company on Wednesday. Among the participants in the negotiations were said to be representatives of the United Corporation, the Schoellkopf interests and the Carlisle group.

According to the *Times'* information, the new consolidated system is to include the Buffalo, Niagara & Eastern Power Corporation, operating at Niagara Falls and in western New York generally, with assets of more than $221,000,000; the Northeastern Power Corporation, operating in northern New York State between the St. Lawrence and the Mohawk Valley, with assets exceeding $131,000,000; the Mohawk-Hudson Power Corporation, operating in the Mohawk and Hudson Valleys, serving the important industrial area around Schenectady, with assets of more than $97,000,000; the Rockland Light & Power Company, operating in Rockland County and neighboring territory, with capital of more than $16,500,000; the Central Hudson Gas & Electric Corporation, serving the Hudson River territory between New York City and Albany, with assets in excess of $29,000,000, and the Eastern States Power Corporation, a twelve-million-dollar holding company owning securities in several of the above companies.

Eventual linkage with the New York City electric utilities is put forward as one objective of the plan. The Associated Gas & Electric system, which recently took in the General Gas & Electric and the Rochester Central Power Corporation, is, the account says, not involved.

Far-Flung Utility Merger Forecast in Bay State

Early acquisition of the grouped electric lighting, power and gas properties of the Massachusetts Utilities Associates is anticipated in connection with the expansion of the New England Power Association system. The above group was brought together about two years ago in a voting trust set-up under the management of C. D. Parker & Company, Boston, and includes about 45 utilities scattered throughout the Bay State from the Cape Cod Canal to northwestern Berkshire County. Among the principal properties are those serving Franklin, Uxbridge, Clinton, Palmer, Amesbury, Weymouth, North

Adams, Great Barrington and other points. It is understood that a large majority of the common-stock holders have signified their willingness to accept an offer of between $20 and $30 per share for their holdings and that the New England Power Association is in a most promising position as a bidder. On this basis the value of the outstanding common stock would be at least $46,000,000. A map of these properties was published in the ELECTRICAL WORLD for September 24, 1927 (page 640).

Charge Los Angeles Utilities with Political Activity

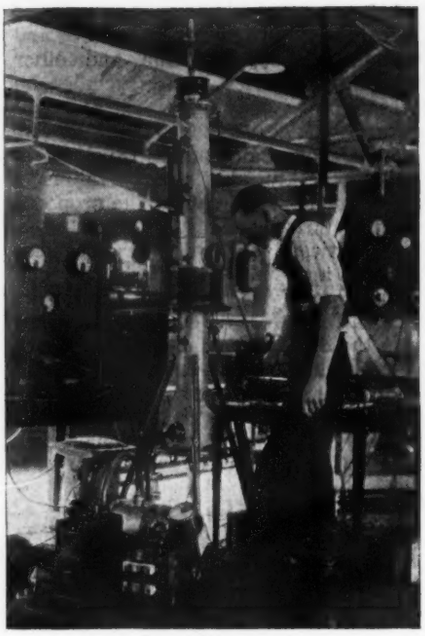
Acting upon its own motion, the Railroad Commission of California has instituted an investigation into the alleged political activities of the Los Angeles Gas & Electric Corporation, the Southern California Edison Company, the Southern California Gas Company and the Southern Counties Gas Company, especially as these are rumored to concern the expenditure of corporation funds or the use of employees in connection with the municipal election in Los Angeles on June 4, when proposals to issue $17,500,000 in power bonds and $22,500,000 in water bonds were defeated (ELECTRICAL WORLD, June 8, page 1207).

The companies have been ordered to appear on June 19, with their books and other records, to give an accounting of all political expenditures made either for or against any measure or candidate voted upon at the election. "Members of the commission's engineering staff," the commission explains, "were assigned to make an investigation as to the alleged activities of the utility companies in the election, with the result that information was obtained of such a nature that the commission considered it necessary to cite the companies to appear and to bring their books and records so that all expenditures of a political nature might be eliminated from their operating accounts as a matter of protection to the ratepayers."

In the Legislative Mills

FLORIDA.—The proposed act to set up a state utilities commission failed in the Legislature, which has adjourned.

TEXAS.—Governor Dan Moody is making another effort to secure the enactment by the Legislature of a law creating a state public utilities commission. The bill which failed to pass at the recent special session has been introduced again at a second special session. Governor Moody declares that "it is beyond possibility that the smaller towns of the state can finance lawsuits to secure just rates, their only recourse at this time, and I am in favor of regulation by the state. I do not say the utility companies are acting corruptly," he observed, "but I do say that men like to make money, and I want the Legislature to give the people a competent body to stand between the men operating utilities and the people."



Du Four-Norinder Oscillograph

Utilities Aid in Study of Lightning Phenomena

New Jersey Public Service, American Gas & Electric and Northern Illinois Company, as Well as Aluminum of America, Will Help Westinghouse

WORKING with four operating companies on 220-kv., 154-kv. and 132-kv. transmission lines, the Westinghouse Electric & Manufacturing Company will in 1929 gather accurate data on lightning behavior. It will use for this purpose five combination Du Four-Norinder cathode-ray oscillographs scattered over territory where lightning prevails.

The unenergized 220-kv. line of the Public Service Electric & Gas Company of New Jersey affords a unique opportunity to study artificial surges between occurrences of natural lightning storms. A portable million-volt surge generator and a mobile Du Four-Norinder cathode-ray oscillograph provide flexible means of studying transients on the transmission system, which is insulated with strings of eighteen insulators each. The station at Stillwater, N. J., will be the one used for study on this line. Other stations equipped with the oscillographs are those of the Aluminum Company of America at Chilhowee and Chota, Tenn., where there is a 154-kv. line; the American Gas & Electric Company at Charleston, West Va., feeding a 132-kv. line, and the Public Service Company of Northern Illinois at Frankfort, Ill., also supplying a transmission line at 132-kv. Klydonographs for registering voltage impact between the elaborate cathode-ray stations, osisos for getting the position of the lightning stroke and fish-eye cameras for photographing the entire sky when lightning flashes are among the auxiliary apparatus.

Recommendations in Aid of Inductive Co-ordination

Joint N.E.L.A. and Western Union Telegraph Committee Reports on Physical Relations Between Electrical Supply and Communication Systems

DRAWN up last November, the report of the joint general committee of the National Electric Light Association and the Western Union Telegraph Company on the physical relations between electrical supply and communication systems is now available in printed form from either of the two bodies named. The committee, of which O. D. Young is chairman, after dealing with crossings and jointly occupied poles, takes up, through its engineering subcommittee, the question of parallel construction generally, whether on separate-pole or joint-pole lines. Recognizing the paramountcy of the public interest in this matter, the subcommittee recommends six general principles for the solution of specific problems in inductive co-ordination which may arise from proximity. These principles are:

A. Co-operative planning should be undertaken for all new construction and major changes in operating practices. This does not include routine maintenance or routine additions to either system.

B. Mechanical construction and design of communication and supply systems should conform to good modern practice. At crossings, at "conflicts" and in joint use the minimum safety requirements of the National Electrical Safety Code should be observed.

C. Location, construction and operation of all supply and communication circuits should be in conformity with mutually accepted methods of general co-ordination. Such additional precautionary measures should be taken as can reasonably be applied under generally prevailing conditions.

D. Where the methods of general co-ordination may be insufficient, the utilities should co-operate in determining and carrying out those specific methods of co-ordination, if any, which will provide the best engineering solution. This involves the selection of co-ordinative measures (1) with due regard to the service requirements of either or both systems; (2) without regard to whether they apply to one system or the other system or to both systems.

E. Each party should be the judge of the quality and requirements of its own service, including the character and design of its own facilities.

F. As far as practicable existing cases should be cleared up in a systematic manner in accordance with the above principles.

Two recommendations with respect to future procedure for the joint general committee are made with a view to continuing and supplementing its work. These are (1) the formation of a committee on principles and practices to prepare a detailed set of them for immediate use and to make such later modifications and additions as may be justified by future development in the art, and (2) the formation of a committee of development and research for a co-operative study of the art of inductive co-ordination in order to determine what practical measures may be developed and adopted to lessen the contributing char-

acteristics of both systems and provide more effective means of co-ordinating these systems.

Agricultural Engineers Will Discuss Electric Service

Meeting at Dallas, Tex., on June 24-27, the American Society of Agricultural Engineers will again devote part of its time to the question of power on the farm and rural electric service. On the afternoon of June 26 Arthur Huntington, public relations engineer with the Iowa Railway & Light Corporation, will answer the query "Where Are We Today in Agricultural Engineering?" R. W. Trullinger of the United States Department of Agriculture will on the following morning discuss "Research in Power and Machinery, 1928," and in the afternoon "Research in Rural Electrification, 1928."

The last-mentioned paper will be given as an item in the program of the rural electric division, over which E. A. Stewart will preside. Other papers at this session are to be:

"Model Farms as Operated by Utility Companies," Richard Boonstra, Public Service Corporation of Northern Illinois.

"The National Project on Rural Electrification," George W. Kable, director.

"Building a Rural Load in the South," C. T. Gilliam, Central Power & Light Company.

"Rural Line Construction in Texas," J. B. Thomas, Texas Power & Light Company.

"The Portable Motor and Its Use," W. D. Hemker, Wisconsin Power & Light Company.

"Latest Recommendations on Farm Wiring," H. S. Hinrichs, Kansas Power & Light Company.

"The Field for the Individual Electric Light Plant," J. R. Golden, Matthews Engineering Company.

"Development and Use of the Wind Electric Plant," George Manikowski, Wind Electric Company.

"Future Program of Activities of the Division," E. E. Brackett, vice-chairman.

Exportations of Energy from Canada to United States

Information available in connection with a bill recently before the Canadian Parliament to take away from the Governor-in-Council authority to grant export licenses shows that the principal exporters at present are the Ontario Hydro-Electric Commission, the Canadian Niagara Power Company and the Cedars Rapids Manufacturing & Power Company of Montreal. The latter company's contract has 68 years still to go. The amount of power exported by the Canadian Niagara Power Company is 50,302 hp. and the price charged is $26.80 per kilowatt per year. The Cedars Rapids Company is exporting 67,881 hp. at $15 per horsepower. Small blocks are being exported from the Maritime Provinces and British Columbia.

During the discussion of power matters in the House of Commons recently certain members expressed the opinion that contracts once made for the export of hydro-electric power to the United States never can be canceled, owing to the vested interests created. Communities large and small and industries which depend upon the power would be disorganized were the supply suddenly cut off. For that reason, the members held, Quebec and Ontario are opposed to the making of further contracts for the exportation of power from those provinces to the United States.

Purchases and Mergers

Connecticut Electric Service Company Acquires Northern Connecticut Power —Eight Small Plants Go to Alabama Power Company

ANNOUNCEMENT is made by President Walter P. Schwabe of the Northern Connecticut Power Company, Thompsonville, of the acquisition of all the common stock of the company by the Connecticut Electric Service Company of Hartford. The purchase will be consummated about July 1. The Northern Connecticut Power Company, which plans a 50,000-hp. hydro-electric development in the Connecticut River at Enfield Falls, now supplies electric service to 40,000 people in South Windsor, Enfield, East Windsor, Windsor Locks, Somers and Suffield. The Connecticut Electric Service Company supplies service to a population of 650,000 in about 85 cities and towns.

The Alabama Power Company will acquire all electric properties of the Alabama Water Service Company if petitions for the transfers submitted to the Alabama Public Service Commission are approved. Under the proposed transfers the Alabama Power Company will acquire the electric plants now serving Fort Payne, Valley Head, Crossville, Porterville, Center, Reesburg, Lebanon and Dawson.

The municipal electric and water plant belonging to the city of Winter Garden, Fla., was purchased by the Florida Public Service Company for $300,000 on June 1. This sale was ratified by a two-to-one vote at an election held on May 28.

The City Council of Shelbyville, Ill., on June 24 will receive bids from prospective purchasers of the city's municipal light and power plant and waterworks and distribution system. The estimated value of the plants is $400,000.

A deal is under consideration for the sale of the Holt (Mo.) Electric Light Company to the Missouri Power & Light Company of Kansas City.

Recent acquisitions of the Oklahoma Gas & Electric Company, in addition to those mentioned last week, include the towns of Charleston, Branch and Ratcliff, Ark., formerly served by the Franklin Utilities Company of Charleston, and Achille, Okla.

Tolna, N. D., by a vote of 63 to 2 rejected an offer of the Otter Tail Power Company to purchase the municipal plant.

Glenrock (Wyo.) voters have carried the proposal to sell their electric light plant to the Mountain States Power Company for $40,000.

Permission has been granted by the California Railroad Commission to J. M. Hotchkiss and Hobbs, Wall & Company to transfer the so-called J. M. Hotchkiss Electric Company properties in Crescent City and vicinity, Del Norte County, to the Public Utilities California Corporation, and the purchaser has been authorized to issue $80,000 of its capital stock in payment therefor.

The City Council of Cumberland, British Columbia, will soon submit to the ratepayers a bylaw providing for the purchase of the plant and distribution system of the Cumberland Electric Lighting Company for $40,000.

Purchase of the electric light and power plants at Torreon, Lerdo and Gomez Palacio by interests associated with the Electric Bond & Share Company of New York City and negotiations by those interests for acquisition of similar plants at San Pedro and other towns in the States of Coahuila, Durango and Chihuahua are the latest reported developments of electric power expansion in Mexico. A large power plant is to be built at Torreon, according to report, and power transmission lines will be erected as rapidly as possible. Possible sale of the Mexico Northern Power Company at Boquillas, Chihuahua, now controlled by Canadian interests, is another current report.

President Appoints Official Delegates to Tokyo

A delegation of seventeen was appointed this week by President Hoover to represent the United States officially at the World Engineering Congress which will meet at Tokyo on October 29. Members of the delegation from Washington are Commissioner Elwood Mead, George Otis Smith, George K. Burgess, O. C. Merrill, Major-General Edgar Jadwin, Scott Turner and John Hays Hammond. From New York Elmer A. Sperry, Frank B. Jewett, John W. Lieb, Maurice Holland, Daniel L. Turner, Byron Eldred, J. V. W. Reynders and Mark Requa have been appointed. John R. Freeman of Providence and Dugald C. Jackson of Boston make up the list.

A.L.E.A. Meeting Elects a New Managing Director

The most important event at the midsummer meeting of the Artistic Lighting Equipment Association, held at Atlantic City, June 5 to 8, was the choice of a managing director to succeed Granville P. Rogers, who has resigned to accept another appointment. Charles L. Benjamin of Chicago was chosen for this position and will soon assume office.

Other interesting features were an address by J. Noble Braden of the American Arbitration Association, who pointed out the value of inserting arbitration clauses on all business contracts for the sale or purchase of material, and a speech by Mr. Bostock of Bostock, Rhoades & Company, New York, on the future of the *art moderne* in lighting fixture designing. Mr. Bostock suggested that lighting equipment of the future will lean toward the architectural style of design.

Meetings of special groups of manufacturers within the A.L.E.A. were held during the week at which questions and problems confronting the members of these groups were discussed.

Central Power & Light Grows Steadily

New Units, Transmission Lines and Substations Are Constantly Being Built in Southern Texas—Combating Salt Deposits on Insulators

COMPLETION of one hydro-electric plant of the series that the Central Power & Light Company of San Antonio, Tex., will build on the Devil's River and approaching completion of another were noted in the ELECTRICAL WORLD for April 20 (page 801). President E. B. Neiswanger of this company says that it contemplates improvements and extensions to its properties in south Texas in 1929 which will cost a sum in excess of $6,000,000. Installation of a 6,750-kw. turbo-generator has been completed at Victoria. A new substation is being completed at Harwood and another will be built at Schulenburg. Right-of-way purchases are virtually complete for a transmission line which the company is going to build between El Campo and Blessing, Tex., and which will result in improved service to Bay City, Matagorda, Markham, Blessing, El Maton and Palacios. The line will be for 66,000 volts and of H-frame construction. It will put the six cities first named on the company's main transmission systems, in addition to the line that now serves them. A line is now being built between El Campo and Eagle Lake which will afford still another source of power for Bay City and adjacent communities.

The company will also begin construction soon on an electric transmission line between Sinton and Robstown, Tex., places about 15 miles apart to the west of Corpus Christi Bay, as a means of eliminating service interruptions which have occurred in the dry months as the result of salt blown in from the bay and deposited on the insulators. The new line will be of two-pole, H-frame construction and will run parallel to the old single-pole line. The line is to be equipped with specially designed fog-type suspended insulators and will be so constructed as to allow greater insulation, should it become necessary. The present line, which runs along the upper end of Corpus Christi Bay, where the water is shallow, will remain standing, but will be operated at lower voltage. It will handle increases in load at Odem and also take care of future rural development between Sinton and Robstown.

In its so-called San Antonio district the company has under construction its section of a transmission line which it is building jointly with the West Texas Utilities Company and which will make the first connection between Fredericksburg and Macon. This line is approximately 40 miles in length. In the Rio Grande Valley the company is installing a 11,250-kw. turbo-generator in its La Palma generating station at San Benito. This gives a total rating of about 26,500 kw. to this station. Construction will be started immediately on a transmission line from San Benito to Weslaco, which will eventually be extended as far as Mission.

The Central Power & Light Company will construct a third power plant on Devil's River, at a cost of approximately $1,500,000, according to President Neiswanger. The site is about three miles from the confluence of Devil's River with the Rio Grande, and the plant will have a capacity of 20,000 hp. A system of power transmission lines will be constructed to towns and industries within a radius of 150 miles.

Besides the major improvements to be made in 1929, many smaller ones are constantly being planned and put into effect in all of the 157 communities which the Central Power & Light Company serves.

New Gatineau River Storage Dam Near Completion

The Gatineau Power Company, which is controlled by the Canadian Hydro-Electric Corporation, a subsidiary of the International Paper & Power Company, reports that its new storage dam on the upper Gatineau River is nearing completion. The reservoir above the dam already holds 3,000,000,000 cu.ft. of water and storage of the remainder will be commenced about September 30 when construction on other cut-off dams is completed.

The new dam—storing the waters of Lake Cabonga—and the present Mercier storage dam will form reservoirs ranking with the large water-storage systems of the world. The aggregate capacity of the two reservoirs will be 145,000,000,000 cu.ft. With a capacity of 45,000,000,000 cu.ft. and draining a territory of 1,150 square miles, the Cabonga reservoir will materially assist the Mercier reservoir in regulating the flow of the Gatineau River, on which the Gatineau Power Company has three hydro-electric plants of a combined designed capacity of 562,000 hp., 436,000 hp. of which power is installed and in operation. In the first four months of this year the company generated 643,664,000 kw.-hr., 89 per cent greater than the corresponding output in 1928.

Rate Reductions and Rebates by Ontario Hydro

Two hundred and forty-three municipalities in Ontario will receive reductions in the rates on service from the Hydro-Electric Power Commission, that body announces. Forty-five municipalities are to receive rebates, leaving only 30 municipalities where no reductions could be recommended by the commission. The rebates have been authorized in the case of municipalities where accumulated surpluses have reached comparatively large amounts and where, in the commission's opinion, it is not advisable at the present time to reduce the lighting rates. Rebates based on from 10 per cent to 25 per cent of 1928 revenues, amounting to from one to four months' customers' bills, will go to all consumers.

District systems profiting in varying degree by the decision of the commission are Niagara, Georgian Bay, central Ontario, Thunder Bay, St. Lawrence, Rideau and Ottawa. Among the larger cities and towns to receive reductions and rebates are Chatham, Galt, Guelph, London, Niagara Falls, Kingston, Peterborough, St. Thomas, Sarnia, Stratford, Welland, Windsor, Woodstock, Barrie, Brockville, Collingwood, Dundas, Ford City, Lindsay, Mimico, Sandwich, Smith's Falls, Walkerville and Waterloo.

First of the Series of Dams to Be Built on Devil's River, Texas

Passamaquoddy Project Now Seeks License

Despite Obstacles Met in Canada, Dexter Cooper Wants to Go Ahead with His Tidal-Power Scheme—Puts Cost at $93,000,000.

By Paul Wooton
Washington Correspondent for the Electrical World

APPLICATION to the Federal Power Commission for a license covering the proposed tidal-power development at Passamaquoddy Bay, Me., has been made by Dexter L. Cooper, Inc. The plan calls for the immediate installation of 464,000 hp. and the ultimate installation of 1,087,000 hp. The project, as previously explained in the Electrical World, contemplates the construction of a series of dams connecting the mainland with islands across the mouth of Passamaquoddy Bay to impound tidal waters within that bay. Another series of dams is to be constructed between Passamaquoddy Bay and Cobscook Bay. The power house is to be erected at that point. In addition there will be a series of dams across the mouth of Cobscook Bay to exclude tidal waters. The plans provide for the installation of suitable gates for the passage of tidal and tailrace waters. There will be a navigation lock connecting the open ocean with Passamaquoddy Bay. Another lock will be located in Cobscook Bay.

A recently adopted feature of the project is a plan to pump water from Haycock Harbor into a reservoir to be constructed on the mainland at an elevation of 140 ft. above sea level. Water will be pumped into this reservoir at such times as excess power is available and drawn down when tidal power is at its minimum. To furnish the necessary power for pumping it is proposed to install five 41,000-hp. units. By making available this power it is expected that many steam plants in Maine, in northeastern Massachusetts and in New Brunswick can be eliminated. Mr. Cooper estimates the cost of the project at $93,000,000. The War Department's district engineer has reported favorably on it, although he is of the opinion that the project will cost $100,000,000 and that it will require seven years to construct. Mr. Cooper estimates that the construction can be done in three years.

The rights granted by the Province of New Brunswick have expired. The government there has refused a request to renew them for two years, and the Dominion Parliament also has acted unfavorably. There is reason to believe, however, that the necessary permits will be issued when definite plans have been made for the prosecution of the work.

A preliminary study made on behalf of the fish industry has resulted in a report stating that the development would eliminate herring from Passamaquoddy Bay, but that a further study will have to be made to determine the effect on fish outside of the bay. Herring are attracted in great numbers to this particular spot.

Briefer News

Harrison and Fayetteville, Ark., and Joplin, Mo., Interconnected.—Current was turned on last week on the new high-tension transmission line of the Southwestern Gas & Electric Company, connecting Harrison, Ark., with Fayetteville, Ark., and Joplin, Mo. Energy will be interchanged over this line between the three cities named.

People's Power Company Ties East Moline, Ill., in with Bettendorf, Iowa.—The People's Power Company has started construction of a substation on Tenth Street, East Moline, Ill., which will cost $300,000. The program includes three submarine cables to connect with the company's Riverside power plant across the Mississippi at Bettendorf, Iowa.

Worcester Electric Light Rebate Aggregates $684,811.—The New England Power Association, the new owner of the Worcester Electric Light Company, is mailing to 55,000 Worcester customers checks aggregating $684,811. The rebate is the difference between the 7-cent rate charged by the old company and the 5-cent rate ordered by the Massachusetts Department of Public Utilities, which has now been accepted by the company.

Ohio Commissioners Study Regulation in Other States.—The Ohio Public Utilities Commission returned to Columbus on May 31, after a ten days' trip through the East. Valuable data on the regulation of public utilities in New York, Massachusetts and Pennsylvania was obtained, and methods in those states will be checked against methods in Ohio, with a view to possible changes.

Central Maine Power Builds 21-Mile, 110-Kv. Line.—A 21-mile transmission line operating at 110 kv. has been completed by the Central Maine Power Company between Bingham, where the company is constructing the Wyman Dam, and Madison. The line, which will be operated for the present at 33,000 volts, is of H-frame type and was built in a little more than three months.

New 132-Kv. Line for Southeastern Oklahoma.—The Public Service Company of Oklahoma is arranging to build an electric transmission line from McAlester to Red Oak designed to carry 132,000 volts. The line will furnish additional power to the mining districts at Hartshorne and Haileyville and later may lead to connections with other towns in southeastern Oklahoma.

Developing Territory in the Finger Lakes Region of New York.—In hitherto untouched territory in the Finger Lakes region of western New York a short power line has just been completed, work has been launched on another 12-mile circuit and plans have been laid for an extension to the village of Reed's Corners, as part of the expansion program of the New York Central Electric Corporation, which has offices at Penn Yan. Three hundred and ten customers will be served by the new lines exclusive of the proposed Reed's Corners project.

Ottumwa, Iowa, Gets State Permission for Hydro-Electric Plant—Permission to construct a 4,000-hp. hydro-electric plant on the Des Moines River has been granted the city of Ottumwa, Iowa, by the state executive comcil. The city holds a preliminary permit from the Federal Power Commission. The work of widening the headrace and constructing the dam and plant may be started next month.

Eugene, Ore., Raises Interest Rate to Get Funds for City Plant.—The city of Eugene, Ore., at a special election has voted to increase the interest rate on municipal utility bonds from 5 to 6 per cent. Several months ago the city advertised a million-dollar issue for sale at 5 per cent but had no bids. Consequently work on the new unit of the municipal hydro-electric system has been delayed.

Electric Club Organized in Portland, Ore.—Election of officers recently marked the final step in the organization of the Electric Club of Portland, Ore. The president is F. H. Murphy, Portland Electric Power Company; vice-president, R. C. Kenney; secretary-treasurer, Fred Zaugg. The club is formed primarily to undertake promotional activities for the benefit of the entire industry in the city, and its purely social function will be subordinated to this purpose.

Permit Sought for Illinois River in Oregon.—Charles H. Lee of Berkeley and R. W. Myers of Oakland, Cal., have applied to the Oregon State Engineer for a permit to store 410,000 acre-feet of water from the Illinois River and to appropriate 800 sec.-ft. of such stored water for the development of 15,400 hp. for mining purposes and domestic supply. The location of this proposed development is in the southwestern part of the state and near the Oregon-California line.

Dispute Over Taxation of Conowingo Plant. — The Susquehanna Power Company, the subsidiary of the Philadelphia Electric Company concerned with production and operation of the Conowingo (Md.) hydro plant, is fighting with the Maryland State Tax Commission in an effort to have the assessed value for taxing purposes of the Susquehanna Power's Maryland properties reduced from about 41 per cent of the cost of the plant in Maryland (put at $45,511,000) to a little more than 27 per cent. Among the points made by the power company's counsel

was that under the federal water-power act the company became an agent of the United States government to keep open navigation on the Susquehanna River and could not be taxed by the state. The Attorney-General of Maryland characterized this contention as a "dream."

HUNTINGTON (IND.) MUNICIPAL PLANT TO ESTABLISH 5-CENT RATE.—Five cents a kilowatt-hour for the first 60 kw.-hr. is the new rate to be charged by the municipal lighting plant at Huntington, Ind., as fixed by a special committee of the City Council. The rate has the approval of the Mayor and will be adopted by the Board of Public Works. The next 140 kw.-hr. will be sold at 4 cents; the next 1,500 at 3½ cents, the next 1,500 at 3 cents and all over 3,200 at 2¼ cents. A minimum charge of $1 a month has been fixed.

SOUTHERN CALIFORNIA EDISON COMPANY BEGINS NEW 220-KV. LINE.—Construction has been begun by the Southern California Edison Company on an 11-mile, 220-kv. transmission line from its Lighthipe substation to a major substation of 150,000-kw. capacity between Torrance and Redondo Beach. The new distribution center will be known as La Fresa substation. An appropriation of $575,000 has been made for the substation building and $370,430 for the double-circuit transmission line.

CONSOLIDATED GAS OF BALTIMORE WINS BEACH TERRITORY AGAINST RIVAL.—Contending that the propriety of its original decision was strengthened by a second hearing, the Maryland Public Service Commission has reaffirmed its order granting the Consolidated Gas, Electric Light & Power Company of Baltimore the right to extend its lines into North and Chesapeake Beaches. The permission was given over the protest of the Suburban Electric Power Company, which plans to establish service for the southern Maryland counties.

OPPONENTS OF HYDRO EXPORTATION IN MAINE STILL ACTIVE.—At a meeting held at the State House, Augusta, Me., June 8, a permanent Consumers' Protective League was formed with Senator Merle J. Harriman of Readfield as president for the purpose of fighting the Smith-Carleton power bill, which goes before the people September 9 on a referendum. The league will try to prevent the exportation of hydro-electric power from Maine. Local branches of the league will be organized in all sections of Maine.

COMING WATER-POWER DEVELOPMENTS IN BRITISH COLUMBIA.—Two of British Columbia's industries, the Powell River Pulp & Paper Company and the Consolidated Mining & Smelting Company, have entered into competition for the right to develop the water resources of Lois River and the Gordon Pasha Lakes at Stillwater, south of Powell River. Records on file place the possible development of Lois River and the Gordon Pasha Lakes at 20,000 hp. to 25,000 hp.——The West Kootenay Power & Light Company has announced that it will require another year to observe the river conditions on the Pend d'Oreille before it will be ready to start construction of its projected 80,000-hp. plant.

CANADIAN ELECTRICAL ASSOCIATION MEETS NEXT WEEK IN NEW BRUNSWICK.—The annual convention of the Canadian Electrical Association will be held at St. Andrews-by-the-Sea, New Brunswick, on June 19, 20 and 21, meeting in the maritime provinces for the first time. The program includes papers by W. A. Jones, vice-president Cities Service Company; C. E. Skinner, research engineer Westinghouse Electric & Manufacturing Company; C. E. Greenwood, commercial director of the N.E.L.A., and R. H. Rogers, industrial engineering department, General Electric Company.

Coming Meetings

[A complete directory of electrical associations, with their secretaries, is published in the first issue of every volume. For latest list see issue for January 5, page 80.]

North Central Electric Association—Breezy Point, Pequot, Minn., June 17-18. J. W. Lapham, 803 Plymouth Bldg., Minneapolis.

Association of Iron and Steel Electrical Engineers—Pittsburgh, June 17-21. J. F. Kelly, 1007 Empire Bldg., Pittsburgh.

Canadian Electrical Association — Algonquin Hotel, St. Andrew's by the Sea, N. B., June 19-21. H. M. Lyster, 712 Power Bldg., Montreal.

Pacific Coast Electrical Association—Del Monte, Calif., June 19-22. S. H. Taylor, 447 Sutter St., San Francisco.

Society for the Promotion of Engineering Education—Ohio State University, Columbus, June 19-22. F. L. Bishop, University of Pittsburgh, Pittsburgh.

Wisconsin Utilities Association — Accounting Section, Sheboygan, June 20-21; Electric Section, Wausau, July 18-19. J. N. Cadby, 432 Broadway, Milwaukee.

Empire State Gas and Electric Association—Accident Prevention Section, Watertown, N. Y., June 20-21; Commercial Section, Hotel Niagara, Niagara Falls, N. Y., June 20-21. C. H. B. Chapin, Grand Central Terminal, New York.

American Society of Agricultural Engineers—Baker Hotel, Dallas, Tex., June 24-27, Raymond Olney, St. Joseph, Mich.

American Institute of Electrical Engineers—Swampscott, Mass., June 24-28. F. L. Hutchinson, 33 West 39th St., New York.

American Society for Testing Materials—Chalfonte-Haddon Hall, Atlantic City, June 24-28. C. L. Warwick, 1315 Spruce St., Philadelphia.

Northwest Electric Light and Power Association—Seattle, June 26-28. B. Snow, 1206 Spalding Bldg., Portland, Ore.

Michigan Section, N.E.L.A.—Mackinac Island, July 1-3. Herbert Silvester, Edison Bldg., Ann Arbor, Mich.

American Society of Mechanical Engineers—Salt Lake City, July 1-4. C. W. Rice, 29 West 39th St., New York.

Camp Co-operation IX — Association Island, Henderson Harbor, N. Y., Aug. 2-6. Society for Electrical Development, 600 Graybar Bldg., 420 Lexington Ave., New York.

International Association of Electrical Inspectors, Western Section — Detroit, Aug. 26-28. W. S. Boyd, 175 W. Jackson Blvd., Chicago. International convention, Vancouver, B. C., Canada, Sept. 9-11. F. D. Weber, P.O. box 745, Portland, Ore.

International Association of Municipal Electricians—Boston, Aug. 27-30. H. N. Lang, Box 1864, Orlando, Fla.

National Association of Railroad and Utilities Commissioners—Glacier National Park, Mont., Aug. 27-30. J. B. Walker, 270 Madison Ave., New York.

NEW TRANSMISSION LINES FOR ILLINOIS.—A high-tension transmission line from Rockford to the vicinity of Belvidere, Ill., will be built by the Rockford Electric Company on authorization of the Illinois Commerce Commission. A permit to construct and operate a 15-mile, 33,000-volt line from Greenview to Andrew, in Sangamon County, has been granted the Central Illinois Public Service Company. Both lines will facilitate rural service in their respective territories.

JACKSONVILLE (FLA.) MUNICIPAL PLANT WILL SUPPLY SOUTH JACKSONVILLE.—The Mayor of South Jacksonville, Fla., has signed the contract by which his city will purchase energy from the city of Jacksonville for twenty years at a rate of 1½ cents per kilowatt-hour. Jacksonville will bear half the cost of building a new substation in South Jacksonville and furnishing needed equipment. The agreement will be terminated in event of annexation.

PLAN TRANSMISSION SYSTEM FOR CENTRAL MISSOURI.—The Missouri Public Service Commission has issued an order authorizing the Western Light & Power Corporation to construct and operate a 13,200-volt transmission system to serve Meta, St. Thomas, Henley, Freeburg, St. Elizabeth, Maryshome, Vienna, Tuscumbia, Eugene and Argyle, all in central counties. The plans comprise erection of a generating plant in Meta.

NEW ELECTRICAL SLOGAN.—A new slogan, "Investigate electric heat," won the first prize of $250 in the recent industrial electric heat contest conducted by the joint committee on electric furnace development of the National Electrical Manufacturers' Association and the National Electric Light Association. It was submitted by W. H. Steinhauer of the engineering department of the Toledo (Ohio) Edison Company. Six smaller prizes were awarded.

WORK BEGINS ON NIAGARA, LOCKPORT & ONTARIO'S NEW HYDRO PLANT ON SALMON RIVER.—After several years' delay due to litigation, the Niagara, Lockport & Ontario Power Company has resumed work on its second hydro-electric development on the Salmon River in Oswego County. The plant will be built at the so-called Lighthouse Hill site in the town of Orwell, a mile down the river from the company's existing plant. Work on this 10,000-hp. development was started five years ago. When operations were suspended the company had spent about $100,000 on

the project. The plans provide for a dam across the river 482 ft. long and 50 ft. high with a power house below the dam. The reservoir will have an area of 175 acres of water surface. The power house will be 120 ft. long and 55 ft. wide and equipped with two turbines.

LAKE ERIE ISLAND GETS POWER FROM MAINLAND.—The Ohio Public Service Company has just completed installation of submarine power service to South Bass Island, 3 miles off shore, opposite Catawba Point, on Lake Erie. Hitherto the island, on which, at Put-in Bay, a monument to Admiral Oliver H. Perry stands, has been dependent on gas-engine-driven generators. A total length of 16,500 ft. of Simplex Wire & Cable Company cable was laid. Public inauguration ceremonies were held at Put-In Bay, where greatly improved floodlighting for the monument was begun.

AN INTERNATIONAL DAM CONSTRUCTION COMMISSION.—As a result of a movement started at the World Power Conference in Basle, Switzerland, in 1926, an International Dam Construction Commission has recently been organized, the object of which is the study of all technical questions in connection with the construction of large dams. The headquarters of the new commission, on which twenty countries are so far represented, are in Paris. Signor Ponti, the president of the Union of Italian Electricity Producers, has been elected the first president of the executive committee of the new body.

TYING NEW YORK'S COMPANIES TOGETHER BY FREQUENCY CHANGERS.—Another step toward rendering interruptions of service almost impossible in Greater New York has just been taken with the completion at the New York Edison Company's Waterside station of a new "tie house," containing two 40,000-kw. frequency converters. These converters furnish a link between the 60-cycle systems of the Brooklyn Edison Company and the United Electric Light & Power Company and the 25-cycle system of the New York Edison, facilitating the interchange of power between these svstems whenever it is desirable.

ROANOKE RIVER DEVELOPMENT BY 1931 HOPED FOR.—Present plans of the Virginia Electric & Power Company for its contemplated hydro-electric developments on the Roanoke River, President W. E. Wood is quoted as saying, involve a plant with an initial output of 25,000 kw. and an ultimate output of 40,000 kw., to be built two miles above Roanoke Rapids, N. C., where the company now has a diversion dam producing 5,000 kw., and a second plant further up the river and astride the North Carolina-Virginia boundary to produce ultimately 50,000 kw. Completion of the lower plant, for which a Federal Power Commission license is pending, is prophesied for 1931. Its cost is put at $7,000,000. If a third Roanoke River project backed by another company for the Buggs Island stretch in Virginia is carried out, nearly all of the flow of the Roanoke River will, it is said, be impounded to aid expected industrial growth in the two states.

FOUR NEW RURAL LINES FOR GEORGIA POWER COMPANY.—The work of rural electrification recently undertaken as part of the expansion program of the Georgia Power Company is going steadily forward. Adding a total of 152 customers, four new rural lines, two in the Atlanta district and one each in the Macon and Athens districts, have been cut in during the past month, the company reports. The new lines are the Panthersville and Lawrencevill Road-Tucker lines in the Atlanta district, the Oconee Heights line in the Athens district and the Williamson line in the Macon district.

SOUTHWESTERN PUBLIC SERVICE ASSOCIATION WAIVES SEPARATE CONVENTIONS.—The governing body of the Southwestern Public Service Association has decided to waive separate conventions in the future, encouraging co-operation of its electrical and other divisions with their respective industry associations in the territory and favoring even greater co-operation with these bodies than in the past. Group and sectional meetings of the association will continue to be held at such times and places as appear profitable. Names of the new officers selected were printed on May 25 (page 1070).

Recent Court Decisions

CONTRIBUTORY NEGLIGENCE AS A MATTER OF LAW.—In affirming a decision for the plaintiff in McCain vs. Trenton Gas & Electric Company, the Kansas City Court of Appeals passed upon a plea of contributory negligence, alleged to have been displayed by the husband of the plaintiff, who fell from a pole on which he was working while endeavoring to close a switch with a "hot stick." The court said: "The wires joined the pole from the east and north, thus placing decedent with his back to the northeast and his face toward the switches. Therefore he had only a quarter of the circumference of the pole between the north and east wires for his work in pulling the switches. It is true that if he could have placed his body on the three-quarters circumference of the pole on its southwest side, he would have had more space. However, in that event he would have been compelled to reach around the pole with the 'hot stick' to have pulled the switches. . . . We hold, therefore, that the question of decedent's contributory negligence was one of fact for the jury. We cannot say he was guilty of contributory negligence as a matter of law." (15 S.W. [2d] 975.)*

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

VALIDITY OF RATES DEPENDS ON PROPERTY VALUE AT DATE OF ORDER AND FOR REASONABLE TIME THEREAFTER.—Declaring that when an appeal is made in a federal court against the rates fixed by a public service commission, the function of the court is not to review the actions of the commission for the purpose of substituting its own judgment, but to determine whether the rates fixed yield such a small return as to be confiscatory, the United States District Court in Indiana sustained the Greencastle Waterworks Company against the Public Service Commission of the state. The court said that the validity of rates fixed for public utilities depends on property value as of effective date of order and for a reasonable time thereafter, since values of such properties do not vary with minor fluctuations of prices of material and labor, but are affected by and generally follow permanent levels and trends of such prices. (31 Fed. [2d] 600.)

Commission Rulings

CUSTOMERS TRANSFERRED TO COMPANY WITH HIGHER RATE OVER THEIR PROTEST.—To avoid duplication of service the New York Public Service Commission agreed to an arrangement by which the Queens Borough and the Nassau & Suffolk gas companies ceased to compete in border territory and the customers of the former in that territory were transferred to the latter. This caused a protest from the customers as it meant an increase in the rate per 1,000 ft. from $1.30 to $1.75. The commission held, however, that the interest of the companies' customers, as a whole, who would have to pay the costs of the duplicate service if it were permitted, was the governing factor in the case.

RATES CHARGED IN OTHER CITIES NO CRITERION.—A petition of customers of the Fitchburg (Mass.) Gas & Electric Company, asking for a rate reduction for electrical energy, was dismissed by the Department of Public Utilities with the following statement: "The petitioners in this case ask for a reduction in the rates now charged for electricity sold and delivered by the Fitchburg Gas & Electric Company. At a public hearing on this petition their representative based his claim for a reduction in rates largely on the ground that other companies in the state were selling electricity at a lower rate than that charged by the Fitchburg Gas & Electric Company and cited the rates charged by companies operating in several other cities and towns in the state. While it is true that rates charged for electricity by other companies are lower, it is obvious that conditions are not alike. The Fitchburg company paid a dividend of 11 per cent on its stock in 1928. This represented 8.35 per cent on its stock and premiums, or the money paid into the treasury of the company by its stockholders. The company since March 1, 1927, voluntarily made three reductions in its household rates and one in its commercial lighting rate. The company stated that it intends to make further reductions in rates as soon as conditions permit. After consideration, we are not disposed to order a reduction in the rates at this time, and the petition is therefore dismissed without prejudice to its renewal."

News About Men of the Industry

Edwin Gruhl New N.E.L.A. Vice-President

Edwin Gruhl, vice-president and general manager of the North American Company, was elected a vice-president of the National Electric Light Association at the recent convention held in Atlantic City. Mr. Gruhl first became identified with the North American Company in 1912 as assistant to the president, and so capably did he perform these executive duties that in 1920 he was appointed a vice-president of the company and the following year was named general manager in addition.

While attending the University of Wisconsin Mr. Gruhl engaged in valuation work for the Wisconsin Railroad and Tax Commissions and subsequently he became statistician of the Wisconsin Railroad Commission, the position he occupied up to the time he joined the North American Company. Early in his career he was vice-president of the Wisconsin Edison Company, Inc., president of the Wells Power Company, both of which are now tied in with the North American system, and assistant to the president of the Milwaukee Electric Railway & Light Company and the Union Electric Light & Power Company of St. Louis. For many years Mr. Gruhl has been active in committee work for the National Electric Light Association, at the present time being a member of the public policy committee.

SAMUEL INSULL, president of the Commonwealth Edison Company, Chicago, has returned to this country after spending three months abroad.

ARCH ROBISON has become vice-president and general manager of the Toledo, Bowling Green & Southern Traction Power Company, Findlay, Ohio; the North Baltimore Service Company, the Rudolph Light & Power Company and the Wooster Electric Company, all in Ohio. These companies are a part of the Empire Public Service Company's system. Mr. Robison has also been made vice-president and general manager of the Western Ohio Railway & Power Corporation. Although the active management of these companies is being taken over by Mr. Robison, F. D. CARPENTER will remain as a vice-president of the Western Ohio Railway & Power Corporation, retiring from the active management after nearly half a century of continuous service in the traction business, during which time he has built up the Western Ohio Railway and become a well known figure in the interurban railway field. Mr. Carpenter expects to devote a larger portion of his time to his other railway interests and extensive personal affairs. CHARLES F. SMITH will continue to serve as a vice-president of the Toledo, Bowling Green & Southern Traction Company, the Rudolph Light & Power Company and the North Baltimore Service Company. He has been in active charge of the Findlay street railway since its very beginning, which was about 40 years ago. He has developed the electric lighting, power and heating business since the consolidation of the Findlay street railway with the old Toledo, Bowling Green & Fremont railway many years ago.

J. S. Tritle Named Westinghouse Vice-President

J. S. Tritle, who recently assumed authority for manufacturing operations of the Westinghouse Electric & Manufacturing Company, as announced in the May 11 issue of the ELECTRICAL WORLD, has just been made a vice-president. Mr. Tritle has been an outstanding figure in the electrical industry since 1893.

E. W. Judy Assumes New Executive Duties

E. W. Judy, formerly operating manager of the Duquesne Light Company, Pittsburgh, was recently elected vice-president and general manager of that company to succeed Frank R. Phillips, who has been elected senior vice-president of the Philadelphia Company. Following graduation from Ohio University, Athens, and a year's construction work with the Scioto Valley Traction Company at Columbus, he entered the employ of the Central Colorado Power Company, Denver, Colo. With that company, and later with the Stone & Webster Engineering Corporation, he worked on some of the largest projects in the West. Later he became district manager of the Southern Sierras Power Company, Riverside, Calif. He entered the employ of the Duquesne Light Company June 18, 1923, as superintendent of overhead lines, being promoted to general superintendent of distribution one year later. In that position he was successful in the establishment of an efficient departmental organization and the adoption of modern up-to-date construction standards. On January 1, 1927, Mr. Judy was appointed operating manager.

Walter Cary Elected President Westinghouse Lamp

Walter Cary, for many years first vice-president of the Westinghouse Lamp Company, has been elected president. Years of activity in the field of electrical illumination have made Mr. Cary known to electrical men in all sections of the country, and his election to his present position was an important additional step upward in his progressive career of twenty-five years in the lamp industry. Mr. Cary was born in Milwaukee and received his education at Harvard University. After leaving college he became associated with the Gibbs Electric Company of Milwaukee and later, with some other local men, he formed the Milwaukee Electric Company, manufacturer of dynamos and motors. He is at present vice-president of the Westinghouse Electric & Manufacturing Company, president of the Bryant Electric Company and president of the Westinghouse Commercial Investment Company. Mr. Cary has been especially active in the affairs of the Electrical Manufacturers' Club, having served as secretary, vice-president and president. He is also a member of the American Institute of Electrical Engineers.

JAMES H. MCGRAW, chairman of the board of the McGraw-Hill Publishing Company, Inc., publisher of the ELECTRICAL WORLD, was made the recipient of the honorary degree of doctor of commercial science by New York University at the commencement exercises held June 12. The citation said: "Educator transformed into publisher, you have never ceased to be an educator. Your notable career accentuates that tendency in commercial life through which, however private in its form, its operations have a public character and become an element in public education."

DAVID DARLINGTON, assistant treasurer of the New York Edison Company, resigned, after a period of service covering more than 33 years. Mr. Darlington entered the employ of the company in 1896 as a junior clerk in the accounting department and advancing steadily in the ranks he became assistant treasurer in 1920. Mr. Darlington was formerly chairman of the Metropolitan New York Section of the National Electric Light Association, and for several years had been chairman of the finance committee of that section. He also served as treasurer of the New York Electrical Society.

R. W. Chadbourn Receives Promotion

Ralph W. Chadbourn has been promoted to the position of assistant superintendent of the department of standardizing and testing of the Edison Electric Illuminating Company of Boston. Mr. Chadbourn was educated at Harvard College and in the Harvard Graduate School of Engineering, from which he received the degree of M.E.E. in 1914. After a short term of service in the street lighting department of the city of Springfield, Mass., he was attached to the organization of Stone & Webster at Boston, entering the Boston Edison company's laboratory in 1916. In 1922 he was appointed head of the standardizing division and held this position until his recent appointment.

Knox Lee Heads Southwestern Association

Knox Lee, who has been connected with the electrical industry in Texas for almost twenty years, was recently elected president of the Southwestern Public Service Association. A native of Comanche, Tex., and a graduate of the Agricultural and Mechanical College of Texas, he entered the public utility field as meter tester for the Fort Worth Light & Power Company in 1910. Subsequently he joined the Stone & Webster organization at Beaumont and after a period of six years transferred his interests to Dallas as distribution engineer for the American Public Service Company. In 1921 he removed to Marshall as division engineer of the East Texas division of that company, later known as the East Texas Public Service Company. Promotion to the position of general manager followed in 1925 and to that of vice-president in 1926. When the Southwestern Gas & Electric Company absorbed the East Texas Public Service Company in 1927 Mr. Lee was named district manager of the Texas division. In addition to his public utility activities Mr. Lee has devoted considerable attention to civic and industrial enterprises.

DR. ALBERT BANNWARTH, DR. KARL CONINX and HERMAN TONNEMACHER have arrived in this country for a short visit. Dr. Bannwarth is director-general of the Hamburgische Electricitätswerke and Mr. Tonnemacher is a member of the board of directors of the Siemens-Schuckertwerke and the general manager of the central-station department. Mr. Tonnemacher took an active part in the development of the high-pressure Siemens-Benson boiler. He has also become known through his work in South Africa in connection with power plant design. Dr. Coninx is the director-general of the Grosskraftwerk Franken with headquarters in Nürnberg, one of the largest power plants in Germany, supplying the industrial part of Bavaria with light and power.

ROBERT B. GROVE, secretary of the United Electric Light & Power Company, New York, has been elected secretary and treasurer and made a director of the Ball Electrical Illuminating Company.

J. E. Goodale Directs Engineering in Queens

J. E. Goodale, assistant electrical engineer of the New York & Queens Electric Light & Power Company, has been appointed head of the engineering division of that company following the resignation of W. C. Blackwood, electrical engineer. Mr. Goodale will have full supervision over all the electrical engineering activities in Queens. Mr. Goodale joined the New York & Queens organization in 1919 as an engineering assistant in the electrical design bureau. Acquiring an intimate knowledge of design work, he was advanced successively to the positions of junior, assistant and electrical design engineer. While serving in the last named capacity he also was given charge of the engineering bureau. In the spring of 1926 he became assistant electrical engineer. Mr. Goodale is a graduate of the Polytechnic Institute of Brooklyn. He is a member of the American Institute of Electrical Engineers, past-chairman of the electrical apparatus committee, Metropolitan (N. Y.) Section, National Electric Light Association and a member of the New York Electrical Society.

JOHN H. N. ADAMS, advertising manager, Mountain States Power Company, with headquarters at Albany, Ore., has resigned to become advertising manager of the Minnesota Power & Light Company, with headquarters at Duluth, Minn.

ALLEN L. SNYDER of New York City has been appointed general manager of the thirty-million-dollar Osage River hydro-electric power plant to be erected by the Union Electric Light & Power Company. He will be in personal charge of the construction of the new plant at Bagnell, Mo., and also of the installation of the two steel transmission lines to connect the new plant with St. Louis. Mr. Snyder, who is a native of St. Louis, was graduated from Harvard University and has served in various engineering capacities for the Stone & Webster Engineering Corporation of New York, which has the contract to build the new hydro-electric plant for the Union Electric. He was assistant to the president of the Hog Island shipyards during the war period and in 1926 became vice-president of the Stone & Webster organization in charge of the division of research and analysis.

Obituary

CHARLES F. BERRY, treasurer of the Cumberland County Power & Light Company, Portland, Me., died suddenly June 9 as a result of a heart attack. Mr. Berry was 63 years of age.

LYLE J. BABBITT, vice-president, secretary and treasurer of the Columbus Railway, Power & Light Company, Columbus, Ohio, died at his home in that city May 28, following a short illness. Mr. Babbitt joined the Columbus company just after leaving high school, 24 years ago. From his position as messenger he rose rapidly through the auditor's office and a year and a half ago he was made vice-president, secretary and treasurer.

WILLIAM HOEN, inventor and one of the pioneers of the electrical industry, died recently at his home in Noblesville, Ind. Early in the '80s Mr. Hoen left his home in Maryland and removed to Cleveland, Ohio, where he became identified with the Brush Electric Company. Later he had charge of the Tom Johnson railways in Cleveland, rebuilt the electric railway system in Muskegon, Mich., and in the '90s took charge of the American Carbon Company's plant in Noblesville. Mr. Hoen was 77 years of age.

HALLER D. SEAVEY, director of public relations and general purchasing agent of the Western Massachusetts Companies, died suddenly June 6 in Atlantic City, where he was attending the convention of the National Electric Light Association. In addition to his duties with the Western Massachusetts Companies he served as general superintendent of distribution and transmission of the Turners Falls Light & Power Company. Mr. Seavey entered the public utility field in Maine, his native state, as an employee of the Public Works Company of Bangor, subsequently joining the Great Northern Paper Company at Millinocket, Me. In 1905 he removed to Greenfield, Mass., with the Greenfield Electric Light & Power Company, later being made superintendent of distribution in charge of all construction work, maintenance of lines through the Connecticut Valley and the selling of supplies as far south as Thompsonville, Conn., and as far west as Pittsfield, Mass. When the United Electric Light Company joined the newly formed Western Massachusetts Companies, Mr. Seavey transferred his interests to Springfield as director of public relations, superintendent of transmission and as purchasing agent.

Financial and Statistical News

ADEQUATELY to characterize this week's stock market would be difficult or impossible. With trading volume at the lowest levels in a year, a few active issues churned about with gains and losses fairly well balanced. The rise of call money to 8 per cent had little apparent effect. Nor had the announcement of the advance oversubscription of the 5⅛ per cent Treasury loan.

——THE RISE IN CALL MONEY is attributed by bankers to the flow-back to out-of-town banks of funds sent here earlier in the month to take advantage of high money rates. With midyear settlements in prospect, however, a further firming of rates is not unexpected, at least toward the end of the month.

——SEVERAL OF THE UTILITY COMMON STOCKS set up new high records again this week. Among the more active issues were Southeastern Power & Light, Penn-Ohio Edison, Commonwealth Power, Superpower A and B, etc. Some of the active issues are now selling at well over thirty times last year's earnings, against the old normal of ten times earnings five to ten years ago.

Small Customer-Ownership Sales in February and March

Sales of electric light and power company stock locally to customers and employees dropped to $6,139,000 in February and to $5,383,000 in March, the smallest totals thus far reported in records going back to June, 1924. The corresponding number of shares sold was 80,300 in February and 70,300 in March, and the transactions were 10,150 and 9,800 respectively, according to the monthly reports received by the ELECTRICAL WORLD. The average transaction was about $607 in February and $547 in March. Only one company had sales nearing $1,000,000 in February and only one other passed the $500,000 mark. The largest sale reported in March was about $750,000 and this consisted of low-priced shares. Two others had sales of about $600,000 each, their shares being in the $100 class.

Bonbright Issues Ninth Edition of Public Utility Survey

The ninth edition of the annual survey made by Bonbright & Company, covering the public utility industry, entitled "Public Utility Points," has just been released. The booklet covers capital invested in the various branches of the utility business, including electric light and power, electric railways, telephone and telegraph companies and the gas industry; growth in gross revenue, output and customers over a period of years and other pertinent statistics. In commenting on the future possibilities of the electric light and power industry the survey says: "The field for future development in the electric power and light industry is so great that capital investment is expected to increase by about 35 per cent and gross receipts by about 37 per cent during the next five years alone." The booklet is being distributed complimentary up to 100 copies. For orders in excess of that amount the nominal charge of 3½ cents a copy is made in order to help defray the cost of printing.

Over 4,000,000 Increase in Motor Drive

An increase of 3,257,951 hp. in electric motors in American manufacturing establishments driven by purchased energy and of 962,042 hp. in motors driven by energy generated in the industrial establishments reporting is indicated by a comparison of the returns of the Census of Manufactures for 1927 with those for 1925. Motorization is therefore progressing at the rate of more than 2,000,000 hp. a year, a pace slightly faster than during the preceding biennium.

There has been a shift from steam engines to turbines, but the total amount of steam plant shows surprisingly little change. The same holds for internal combustion engines and for hydraulic units. In fact, the increase in total power, 3,233,996 hp., is almost exactly accounted for by the increase in motor horsepower driven by purchased energy.

But while the total of steam, internal combustion and hydraulic drive has remained almost constant, being 19,902,308 hp. in 1925 and 19,878,351 hp. in 1927, more and more of this power is being applied electrically, rather than by direct mechanical means. Evidence is the 634,041 kw. increase in rating of generators and 962,042 hp. increase in motors driven by them.

General Electric Declares Extra Dividend

The General Electric Company declared an extra dividend of $1 on the common stock in addition to the regular quarterly dividends of $1 on the common and 15 cents on the special stock, all payable July 26 to stock of record June 21.

New Utility Offerings

Convertible 6 per cent ten-year gold debentures, series B, of the Keystone Water Works & Electric Corporation were offered during the past week at 97½ and interest, to yield about 6.35 per cent, a piece of financing involving a total of $2,200,000. Proceeds from the sale of this issue of series B debentures, convertible into class A stock, will be used, in part, for the acquisition by the company of certain of its first lien bonds, to reimburse the company for indebtedness incurred in connection with extensions and additions to the properties of subsidiaries and for other corporate purposes.

The Texas-Louisiana Power Company made an offering of first mortgage 6 per cent gold bonds, series A, to the amount of $1,600,000, the price being 97½ and accrued interest to yield 6.25 per cent. Proceeds of this financing will be used to reimburse the company in part for construction expenditures, for the acquisition of the properties of the Texas-New Mexico Power Company and for other corporate purposes.

A ten-million-dollar offering was made by the Central States Electric Corporation in the form of convertible preferred stock, optional series of 1929, at $100 a share. This stock is convertible at the option of the holder into common stock of the company at the rate of one share of common stock for each $118 par value of this preferred stock.

An additional issue was offered by the Southern Public Utilities Company in the form of first and refunding mortgage 5 per cent gold bonds to the

Horsepower of Prime Movers in Manufacturing Establishments

	1927	1925	Change
Total rated capacity	39,000,940	35,766,944	+ 3,233,996
Steam engines	10,140,381	11,433,272	— 1,292,891
Steam turbines	6,783,550	5,482,468	+ 1,301,082
Internal combustion engines	1,170,774	1,185,738	— 14,964
Water wheels and water turbines	1,783,646	1,800,828	— 17,182
Electric motors driven by purchased energy	19,122,589	15,864,638	+ 3,257,951
Electric motors driven by energy generated in establishment reporting	11,216,700	10,254,658	+ 962,042
Electric generators (kw.)	7,520,855	6,886,814	+ 634,041

amount of $8,000,000, the price being 100½ and accrued interest.

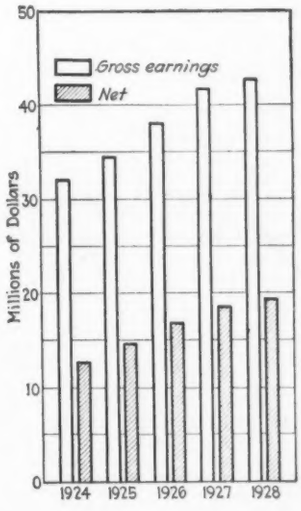
The General Gas & Electric Corporation issued 250,000 shares of $6 cumulative convertible preferred stock at $95 per share and accrued dividend, yielding 6.30 per cent. Each share of this stock will be convertible into one and one-fifth shares of the common stock, class A, of the corporation.

Associated Gas Shows Impressive Growth During Year

SHOWING an increase in gross earnings of 19 per cent to a total of $42,163,550, the Associated Gas & Electric Company made a very impressive advance during the calendar year 1928. For the same period net revenue of $19,176,637 showed an increase of 13 per cent.

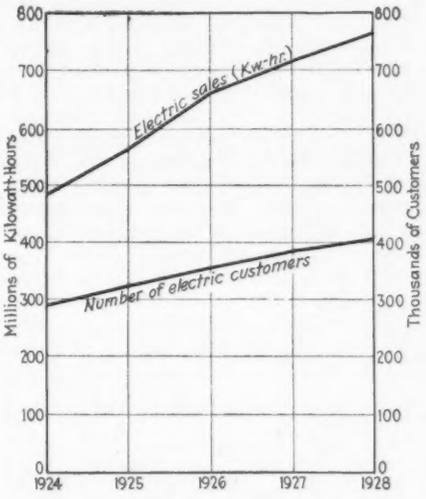
The properties of the Associated system provide electric light and power, gas, water and transportation service to more than 635,000 customers in territories with a total population exceeding 2,700,000. A total of 767,098,646 kw.-hr. of current was sold in 1928, against 714,792,782 kw.-hr. in 1927, and more than double the sales of approximately six years ago. The company's total assets at the end of last year were $318,514,494, which compares with a total of $62,257,097 at the end of 1924.

The Associated Gas & Electric System is active also in the distribution of appliances. Gross sales of electric and gas appliances were nearly four times as great in 1928 as in 1927, the total amount of such sales for last year being more than $2,500,000. In 1926 the system undertook to establish and centralize a new-business department for the purpose of developing greater use of electricity and gas in the territories served. This department carries a program for installing efficient housewiring, including the rewiring of old homes and the introduction of convenient outlets.



Associated Gas Earnings Show Consistent Growth

The financial policy of the Associated Gas & Electric System involves the essential feature of financing through the securities of the parent company primarily, instead of through the subsidiaries. The company claims for such a policy three distinct advantages: (1) It provides a wider diversification of business and earnings for the securities of the company; (2) by substituting parent company's securities for underlying company's securities, the earnings are more directly applicable to the securities of the parent company; (3) because of the many operating units geographically diversified within a large system of properties, the individual security issues are far larger and consequently have wider distribution and greater marketability than those of an individual operating unit in a restricted area.



Electric Customers and Sales Covering Five-Year Period

The company cites the following arguments as justifying its policy: (1) Associated Gas bonds, since early in 1927, have been selling on a rapidly increasing yield basis; financing during 1928 was done with 4½ per cent and 5 per cent bonds, against 5½ per cent bonds the year before; (2) there is a very material reduction in mortgage and secured debt, with a consequent strengthening of the financial position and borrowing capacity of the company.

During the past year the company purchased, through subsidiaries, several properties which were near those already owned and which could be advantageously operated in connection therewith. These properties were, for the most part, comparatively small properties in territories adjacent to those in the New York, Canadian and Philippine groups.

The company has been exceedingly active in the customer-ownership field. The management has had in operation for seven years a customer-ownership department for the purpose of giving customers served an opportunity to invest in securities of the company. More than $36,000,000 of securities, chiefly preferred stocks, have been sold to approximately 40,000 customers during this period. Of this amount, more than $13,000,000 of securities were sold to approximately 19,000 customers during the year 1928.

American Superpower Votes Rights

Directors of the American Superpower Corporation have voted to give common-stock holders of the company rights to subscribe at $15 a share to stock of the Commonwealth & Southern Corporation on the basis of one Commonwealth & Southern share for each ten common shares of American Superpower held after the split-up of the present stock. The privilege is extended to stockholders of record June 18 and the rights will expire July 2.

United Corporation Increases Capitalization

At a recent meeting the directors of the United Corporation voted, subject to the stockholders' approval of the necessary increase in stock, to give to the common-stock holders of record July 10, 1929, the right to purchase at $37.50 a share additional common stock on the basis of one new share for each five shares held on the record date. Rights expire August 15. A stockholders' meeting has been called for July 10, 1929, to authorize an increase in the capital of the company from 13,000,000 to 30,000,000 shares, of which 1,000,000 will be first preferred, 5,000,000 will be preference and 24,000,000 will be common stock.

Spokane Utility Closes Big Customer Campaign

Thirty thousand shares of six-dollar preferred stock were sold by the Washington Water Power Company in a sale lasting eleven business days and closing on May 27. The issue, which was oversold by 2,200 shares, was bought by 4,880 customers and employees.

OKLAHOMA UTILITY INCREASES CAPITAL.—The Public Service Company of Oklahoma has increased its capital stock from $23,000,000 to $32,000,000. Permission was granted by the Corporation Commission of Oklahoma following formal voting of the directors and stockholders at the annual meeting in March. While the company has announced no definite improvement program, the money has been made available for future development of the territory served by the company as it is needed within the year.

May Sets New Production Record

GENERAL manufacturing operations in the United States in May, corrected for seasonal variation, and based on electrical energy consumption, were by far the highest on record, surpassing the previous high monthly rate, which occurred during the previous April, by 3.3 per cent. The May rate, not corrected for seasonal variation, was 0.4 per cent above April, but was 2.6 per cent under the peak of general productive operations reached in February. Compared with May, 1928, the current operations were on a plane 15 per cent above May last year. The first five months of the current year has witnessed an average rate of manufacturing activity 13.2 per cent over the same period in 1928.

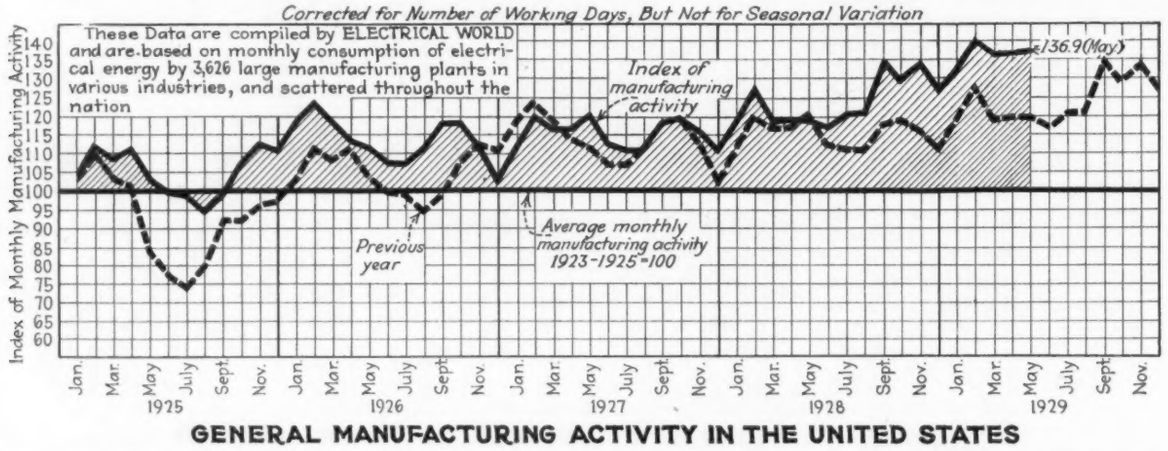
Every section of the country reported May rate of operations materially over May last year. The Western States lead with a gain of about 31 per cent, followed by the Southern States with a gain of 17.4 per cent, the North Central States with 17.1 per cent, Middle Atlantic States 15.5 per cent and New England reporting a gain of 13.0 per cent.

All but two of the manufacturing groups—leather products, and paper and pulp—recorded a material gain during May over May of last year. The largest gain over last year, and a record rate of activity, was reported by the rolling mills and steel plants. These plants recorded the very unusual gain of 12.3 per cent over April and a gain of 37.8 per cent over May last year. During the first five months of the year the average rate of operations by these plants was 25.4 per cent over the same period last year. May rate of operations in the ferrous and non-ferrous metal working plants was about 2.8 per cent under April, but was still 17.5 per cent over May, 1928.

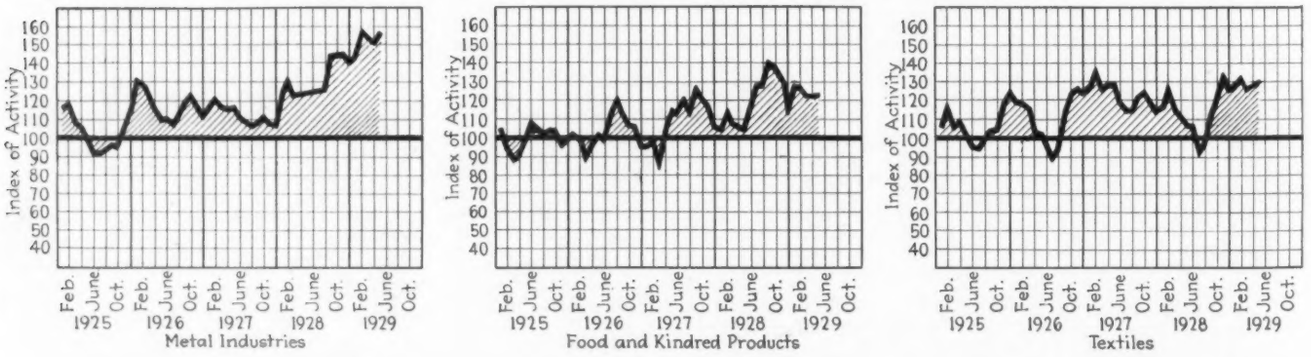
The automobile manufacturing industry, including the manufacture of parts and accessories, recorded a drop in operations during May of 5.2 per cent as compared with April, but was still on a plane 14.3 per cent above May, 1928. It appears, therefore, that the peak of operations in these plants during the present season was reached in April, as was the case last year.

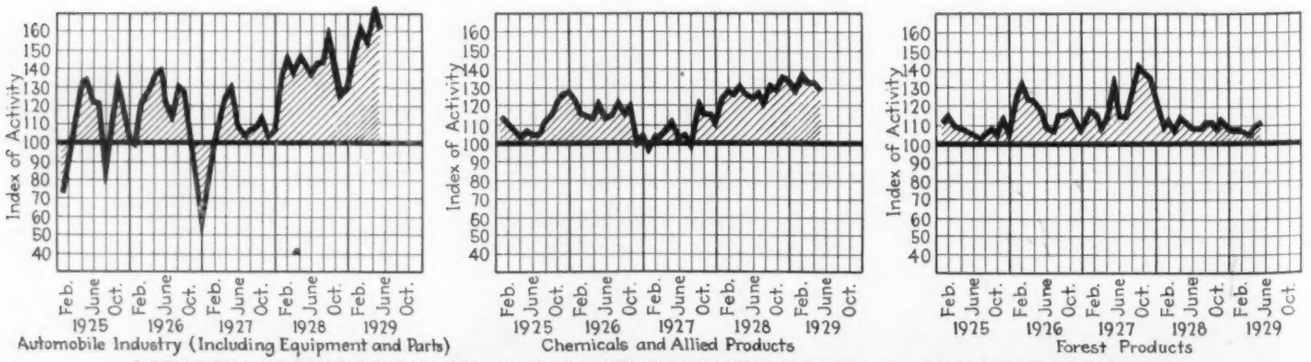
Textiles, which at this time last year was witnessing a distinct slump, recorded a May rate of activity 1.4 per cent over April, and was 22.9 per cent over May last year.

AMERICAN BROWN BOVERI TO PAY 14 PER CENT DIVIDEND IN ACCUMULATIONS. — Directors of the American Brown Boveri Electric Corporation have declared a regular quarterly dividend of 1¾ per cent and a dividend of 14 per cent on the 7 per cent cumulative preferred stock (covering the two years' dividend accumulation that existed on the issue), payable July 1 to holders of record June 20. The last preferred distribution was made on April 1, 1927, when 1¾ per cent was paid.


Corrected for Number of Working Days, But Not for Seasonal Variation
These Data are compiled by ELECTRICAL WORLD and are based on monthly consumption of electrical energy by 3,626 large manufacturing plants in various industries, and scattered throughout the nation
Index of Monthly Manufacturing Activity
Index of manufacturing activity
136.9(May)
Previous year
Average monthly manufacturing activity 1923-1925=100
Jan. Mar. May July Sept. Nov.
1925 1926 1927 1928 1929

GENERAL MANUFACTURING ACTIVITY IN THE UNITED STATES





ACTIVITY IN THE PRIMARY MANUFACTURING INDUSTRIES OF THE UNITED STATES

Business News and Market Conditions

Recent Economic Changes Committee Reports Findings

Acceleration rather than structural change is the key to an understanding of the recent economic advancements of the nation and the maintenance and extension of the economic balance between production and consumption is suggested as the means of insuring an increasingly prosperous future for the United States, according to the findings of the Committee on Recent Economic Changes of the President's Conference on Unemployment.

"To maintain this balance, and to extend it into fields which are not now in balance with the more prosperous elements of the nation is clearly an important problem of leadership," it says, asserting at another point that "we seem only to have touched the fringe of our potentialities."

The committee bases its prediction of a continuous rise of living standards on the maintenance of high wages in the light of the "insatiable commodity demand," an increasing application of scientific and management skill and on the elimination of speculation.

The skillful application of "the principle of equilibrium" in every economic relation if the nation is to "maintain our economic advantage or fully hope to recognize our economic future" is the "outstanding fact" pointed out by the survey.

"If natural resources are wastefully used; if money in quantity is taken out of production and employed for speculation; if any group develops a method of artificial price advancement which puts one commodity out of balance with others; if either management or labor disregards the common interest—to this extent equilibrium will be destroyed for all."

A maintenance of high wages, in the light of the report, would assure the continuous advance of living standards for the majority of the nation's population.

"The survey has proved conclusively," the report continues, "that wants are almost insatiable; that one satisfied makes way for another. The conclusion is that economically we have a boundless field before us; that there are new wants which will make way endlessly as fast as they are satisfied."

Advancing use of automatic machinery, it is agreed, causes "technological" unemployment, as displaced workers were forced to find jobs elsewhere than in their original industry. But the increasing output of goods and increasing demand for sales and services in connection with their use, the increasing of leisure and consumptive wants developed in leisure are said to have provided a field for filling the employment gaps.

The report deals with the period from 1922 to 1929 and is the third survey growing out of the President's Conference on Unemployment of 1921, the two former reports having to do with business cycles and unemployment and with seasonal operations in the construction industries.

Electric Industrial Trucks and Tractors

April shipments of electric industrial trucks and tractors, as reported to the Department of Commerce by the eleven leading manufacturers in the industry, were 194, as compared with 211 in March and 136 in April, 1928.

Shipment of Electric Industrial Trucks and Tractors

		Domestic		
1928	Total	Tractors	All Other Types	Exports
January	112	5	98	9
February	119	15	86	18
March	129	18	95	16
April	136	9	121	6
Four months	496	47	400	49
May	114	8	93	13
June	116	6	96	14
July	107	5	87	15
August	96	5	85	6
September	118	11	102	5
October	134	5	109	20
November	132	9	117	6
December	153	10	126	17
Total (year)	1,466	106	1,215	145
1929				
January	152	4	129	19
February	134	10	121	3
March	*211	14	*187	10
April	194	12	169	13
Four months	691	40	606	45

*Revised.

British Central Electricity Board Issues Report

Substantial progress has already been made toward the complete electrification of the United Kingdom, which is the ultimate objective of the electricity (supply) act of 1926. Schemes of the Electricity Commissioners for the supply of electricity in bulk, which have actually been adopted by the Central Electricity Board, cover 42 per cent of the country's total area and nearly 75 per cent of its population.

Ultimately, by means of the grid system of main transmission lines, cheap electricity will be available in practically every part of Britain. Contracts placed by the end of last year totaled nearly £3,000,000 ($15,000,000), but in the following three months additional contracts brought the aggregate value of the work in hand to £8,150,000 ($40,750,000). Electricity is now being supplied by the line from Bedford to Little Barford, to which falls the distinction of being the first section of the whole scheme to come into actual operation. The line from Clyde's Mill to Bonnybridge (Glasgow) will also be brought into service within a very short time.

The full story of this beginning is told in the first annual report of the Central Electricity Board, which has just been issued. It covers the period from the setting up of the board on March 1, 1927, to December 31, 1928. According to the report, the function of the Central Electricity Board is "to co-operate with the supply industry in reducing the cost of production."

Imports of Electrical Apparatus

First Quarter of 1929

(Data furnished by the Bureau of Foreign and Domestic Commerce)

Article	First Quarter
Carbon-filament incandescent electric lamps:	
Miniature	$156,282
Other lamps	93,057
Metal-filament incandescent lamps:	
Miniature	1,238
Other lamps	1,176
Other electric lamps, including neon, etc.	1,885
Transformers	24
Converters, double-current and motor-generators, dynamotors and other converting apparatus	.....
Switches, circuit breakers, fuses, choke coils, reactors, sockets, plugs, etc	738
Motors, stationary, railway, vehicle, automotive, and other	1,499
Table, household, kitchen and hospital utensils and similar hollow or flat ware containing electrical heating element:	
Electric flatirons	390
Therapeutic apparatus and X-ray machines	10,588
Radio and wireless apparatus and parts	34,671
Telegraph apparatus	1,762
Telephone apparatus	29
Storage batteries and parts	1,479
Batteries other than storage	256
Electrical machinery and parts	81,270
Electric apparatus and parts	183,787
Total	$570,131

Country	First Quarter
Austria	$43,579
Australia	97
Azores and Madeira Islands	.....
Belgium	2,266
Brazil	.....
British Honduras	.....
British West Indies	.....
Canada	6,059
Ceylon	.....
China	.....
Cuba	.....
Czechoslovakia	330
Denmark	1,857
Finland	50
France	15,067
Germany	126,916
Hungary	.....
Italy	492
Japan	182,306
Mexico	.....
Netherlands	1,506
Newfoundland and Labrador	139
Norway	332
Philippine Islands	.....
Portugal	.....
Roumania	.....
Spain	.....
Sweden	144,803
Switzerland	4,404
United Kingdom	39,928
Total	$570,131

Market Conditions

THE volume of equipment business is largest in the East and West Coast areas this week. Work in prospect on the Pacific is probably the largest on record. On the North Pacific motor sales are a feature.

——THE HIGH-LIGHT IN MIDDLE WEST business at the moment is new construction by the utilities, especially circuit revision work.

——IN THE SOUTHEAST central-station business is normal. The largest orders recorded are for power transformers.

——HEAVY INDUSTRIAL EQUIPMENT ORDERS have declined in New England, where buying in general is somewhat less active than during recent weeks.

——AS INDICATED ALREADY, THE EASTERN SEABOARD is a high spot in equipment business and there is virtually no indication, as yet, of seasonal recession.

Industrial Business Advances in Eastern District

Industrial account shows greater activity in the Eastern district, and with sales to central stations holding at a satisfactory level, there is little indication of the anticipated seasonal recession. A New York manufacturer of insulating and building materials has placed an order for a 750-kw. turbo-generator for a New Jersey plant, costing $40,000. A contracting company in Minnesota has purchased electric drives for locomotives of gas-electric type from a New York interest, amounting to $60,000. A metropolitan copper company has given a contract to a New York manufacturer of switching equipment totaling $50,000 for a plant installation in Texas. A manufacturer of motors reports brisk inquiries from iron and steel mills, with expectation of early orders for heavy mill type units from the Pittsburgh and Birmingham districts. Another active quarter of demand is the automobile plants centered in Michigan and already a sizable account has been secured for motors, switching equipment and accessory apparatus. A maker of cars is in the market for about 500 small capacity motors for general service.

A feature of the week in the Eastern district is the beginning of active work by the Delaware, Lackawanna & Western Railroad Company for the proposed electrification of a portion of its suburban lines in New Jersey, totaling 173 miles of track. Bids will be received at New York until June 24 for steel structures for catenary supports, totaling about 4,000 tons. Closely following, bids will be asked for substation equipment and for structural steel and other required materials. The railroad has abandoned plans for a central station and has contracted for power with the Public Service Electric & Gas Company, the Jersey Central Power & Light Company and the New Jersey Power & Light Company, respectively. The entire project is estimated to cost $15,000,000.

Central stations show an improved call for high-tension equipment. Switching apparatus is under a more active call. A metropolitan central station has placed a commitment for equipment of this kind with a State maker, costing $60,000. A power company in Tennessee has ordered a synchronous condenser unit, with miscellaneous switchgear and auxiliaries to an amount of $40,000. Condenser demand is trending upward and the outlook is favorable. Wire and cable account shows little change. Construction projects are as follows:

The Mohawk Carpet Company, Amsterdam, N. Y., plans extensions to cost $1,000,000. The Crouse-Hinds Company, Syracuse, N. Y., will build an addition to its electric device manufacturing plant to cost $135,000. The Curtiss Airports Corporation, New York, plans an airport and flying field in the Bronx to cost $2,500,000. The Quisenberry Feed Manufacturing Company, Buffalo, N. Y., plans a mill and elevator to cost $250,000. The Rochester Packing Company, Rochester, N. Y., will soon take bids for a cold storage plant to cost $150,000. The General Motors Corporation, Detroit, plans an assembling plant at Tonawanda, N. Y., to cost $500,000. The Fairchild Aviation Corporation, New York, will build an assembling and service plant at Amityville, L. I., to cost $100,000. The Sonatron Tube Company, Newark, N. J., plans an addition to cost $125,000. The Gilby Wire Company, Newark, N. J., will build an addition to cost $60,000. The Public Service Electric & Gas Company, Newark, N. J., plans a power substation at Keasbey, N. J., to cost $140,000 and a substation in the Hackensack district to cost $250,000. The Pitcairn Aircraft, Inc., Philadelphia, plans a plant at Hallowell, Pa., to cost $100,000. The Bethlehem Steel Company, Bethlehem, Pa., plans extensions in its mill at Lebanon, Pa., to cost $1,000,000. The Department of City Transit, Philadelphia, will build a substation to cost $160,000. The Frankford Grocery Company, Philadelphia, will build a storage and distributing plant to cost $500,000. The Fourth Avenue garage, Pittsburgh, will take bids for a service, repair and garage building to cost $275,000. The American Oil Company, Baltimore, Md., plans an oil storage and distributing plant at Atlantic City, N. J., to cost $85,000, and contemplates expansions in similar plant at Wilmington, Del., to cost close to a like amount. The Quartermaster, Marine Corps, Washington, will receive bids until June 20 for two refrigerating units (Schedule 799). The Bureau of Yards and Docks, Navy Department, Washington, is asking bids until June 19 for an electric distributing system at the Marine Barracks, Parris Island, S. C., including poles, insulators, high-tension mains, etc. (Specification 5905.)

Buying Quiet in New England District

Less activity in buying is reported in the New England district. Heavy industrial equipment orders have fallen off, but central-station supplies are moving well. Small motor sales, according to one manufacturer, are steady and machine tool manufacturers are buying in good volume. Recently one order for a group amounting to about $2,000 was received. Over 200 hp. in motors was recently added to a New Hampshire tannery. Transformer sales are steady, while line extensions are numerous and the volume of materials required is very encouraging. New station construction materials and apparatus are in fair demand. Insulator sales are steady in small lots and line material shipments are increasing. While negotiations are quiet there is projected in engineers offices a very encouraging volume of new construction projects which presage favorable business for the latter half of the ensuing year. Construction projects are as follows:

The Otis Elevator Company, Boston, plans an addition to cost $100,000. The Worcester Wire Works, Inc., Worcester, Mass., plans an addition to cost $50,000. The Aircraft Corporation of America, Milford, Conn., will build an aircraft manufacturing plant, to cost $75,000.

Orders for Transformers Head List in Southeast

Little activity of an unusual nature is to be noted in the Southeast at this time. The general volume of business is reasonably well sustained, but no individually large orders are reported in the central station line and only one is reported in the industrial. A power company in Mississippi ordered $25,000 in power transformers, while a Georgia company's orders for poles and line materials aggregated $11,000. One company ordered $4,600 in sign equipment for installation at branch stores. Some other central-station orders were for transformer equipment amounting to $4,000, insulators amounting to $2,500 and small switching equipment totaling $1,661. The only outstanding order from industrials was placed by an Alabama steel mill for 7,000 hp. blooming mill machinery approximating $250,000. A tire fabric manufacturing plant in Georgia ordered $8,000 in wiring supplies, while a rayon plant in the same state ordered $6,000 in wiring supplies and $2,000 in residential lighting fixtures for its mill village. A cotton mill in Georgia ordered $4,000 in distribution materials for its mill village system, and another manufacturing plant in that state ordered three carloads of creosoted pine poles. Two Georgia municipalities signed contracts covering the construction of "whiteway" systems. Construction projects are as follows:

The Blue Diamond Coal Company, Cincinnati, Ohio, plans a coal mining plant

near Bonny Blue, Va., to cost $500,000. The Scohy Sheet Glass Company, Sisterville, W. Va., will make extensions to cost $80,000. Carrollton, Ky., plans an ornamental lighting system. The Duke Power Company, Charlotte, N. C., plans a power substation at Winston-Salem, N. C., to cost $100,000.

Prospective Building on Coast Unprecedented in Volume

Business is very good on the Pacific Coast, with many new jobs in sight and much work still in the estimation stage. There is an unprecedented amount of new work, largely as a result of such missionary and selling effort, as the Pacific Gas & Electric Company's lighting and range campaigns. Power company business included three carloads of hardware, two carloads of sizes 4 and 6 bare copper wire, three carloads of 4,500-volt sector cable, sizes 0 to 1,000,000 circ.mil, and many miscellaneous maintenance orders. The jobs being figured include the naval munition plant at Hawthorne, Nev., involving 80 buildings, and new buildings for the University of Nevada at Reno. The Southern Pacific Company's annual lamp contract, effective July 1, covers $150,000 worth of large and miniature lamps and is being figured. The city of Oakland's lamp requirements are also being figured. Machinery orders include a group of 500-kva. transformers valued at $10,000 for the Southern California Edison Company, $20,000 worth of meters, switches and transformers for an Arizona copper mine, a $15,000 Diesel engine generator for another, and Westinghouse car equipment for four electric-gasoline interurban coaches for a steam railroad. Street-lighting business covers a $10,000 award at Salinas, a $3,500 award at Santa Barbara, and 55 single light jobs at Berkeley and Sacramento, Calif. The Pacific Gas & Electric Company is in the market for annual crossarm requirements estimated at 50 carloads.

Apparatus sales were very light in the Puget Sound district, although there are several orders from central station companies and pulp and paper mills in immediate prospect. The motor movement was reported from fair to good. The Western Washington Electric Light & Power Company, a subsidiary of the Federal Light & Traction Company, is starting construction of a three-and-a-half-million-dollar dam and reservoir on the North River, in Pacific County, the first step in connection with the installation of two 12,500-hp. generating units, to be followed later by a third of similar capacity. Forty miles of 66,000-volt transmission line, serving the Grays Harbor cities, also will be constructed. The city of Seattle for the time being has abandoned the plan for the three-million-dollar dam at Hanging Rock and will spend $25,000 in raising the Crib dam now serving the Gorge Creek plant. The city of Seattle is now taking bids for 100,000 lb. of Nos. 2 and 4 weatherproof copper wire and the city of Tacoma for a year's supply of glassware for street lighting and commercial lamps. The Puget Sound Power & Light Company will build about 75 miles of rural transmission lines in Snohomish County. The city of Seattle awarded a contract for a power tunnel from the Diablo dam, a portion of the Skagit hydro-electric project, to Rumsey & Jordan, Seattle, for $544,894. Construction projects are as follows:

The Cudahy Packing Company, Omaha, Neb., plans an addition to the packing plant and lard refinery at Los Angeles, Calif., to cost $100,000. The Kinner Airplane & Motor Corporation, Los Angeles, plans additions to cost $200,000. The E. L. Travia Industrial Terminal Corporation, Los Angeles, plans a plant to cost $5,000,000. The Holland Fertilizer Company, Bellingham, Wash., contemplates a plant to cost $100,000. The Washington Irrigation & Development Company, Seattle, plans a hydro-electric power plant on the Columbia River in Grant County, Wash., with a capacity of 200,000 hp., to cost $30,000,000. The Great Northern Railway Company, St. Paul, Minn., plans extensions in the shops at Hillyard and Spokane, Wash., to cost $125,000. The General Petroleum Corporation, Seattle, Wash., plans an addition to the storage and distributing plant to cost $100,000. Black Eagle, Helena, Mont., and Gallup, N. M., plan ornamental lighting systems. The Montana-Dakota Power Company, Minneapolis, Minn., plans steam-operated electric power plants at Richey and Circle, Mont., respectively, to cost $150,000. The Harmony Mines Company, Salmon, Idaho, plans a power plant to cost $70,000. The Illinois Zinc Company, Chicago, plans extensions in the plant at Deming, N. M., to cost $200,000.

Business in St. Louis Shows Little Change

There has been very little change in conditions in the St. Louis district. In spite of labor troubles there has been a good volume of construction material moving. The demand for apparatus of all kinds is holding up, but there have been no orders of exceptional size reported. One order amounting to $2,500 was for motors and transformers, a switchboard for the municipal plant in southeast Missouri costing $3,000 and a lot of poles, insulators and wire for a power company in northern Arkansas to cost $3,750 are all the orders worthy of note. Construction projects are as follows:

The American Asphalt Roof Corporation, Kansas City, Mo., plans an addition to cost $100,000. The Green Brothers Grocery Company, Kansas City, Mo., plans a storage and distributing plant to cost $130,000. The St. Louis Electric Terminal Railway Company, St. Louis, plans a freight and express terminal building to cost $1,000,000. The Ozark Copper Company, Springfield, Mo., plans extensions in its plant at Winona, Mo., to cost $80,000. The Atchison, Topeka & Sante Fe Railway Company, Chicago, plans extensions in shops at Emporia, Kan., to cost $150,000. The Osage Aircraft Company, Pawhuska, Okla., plans an airplane manufacturing plant to cost $70,000. The Public Service Company of Oklahoma, Tulsa, Okla., will make extensions in its street lighting system. The Standard Gravel Company, Shreveport, La., plans a plant at Camden, Ark., to cost $75,000. The Texas Power & Light Company, Dallas, Tex., plans a transmission line from Springtown to Boyd, Tex., to cost $50,000. The Premier Granite Quarries, Inc., LaGrange, Tex., plans a plant at Llano, Tex., to cost $65,000. The Texas Electric Service Company, Dallas, Tex., plans extensions in the street lighting system at Midland, Tex. Teague, Tex., plans a municipal electric light and power plant to cost $115,000. The Lafayette Compress & Warehouse Company, Lafayette, La., will build an addition to cost $100,000. Shreveport, La., plans a floodlighting system and beacon lamps at its municipal airport.

Utility Companies Active in Middle West

The volume of business is increasing slowly and all indications seem to point to a continuation of the present prosperous condition in the Middle West. Settlement of the iron workers' strike in the Chicago district is looked upon as a favorable indication for building activities. The utility companies are busy with a large amount of construction, particularly circuit revision work. Some interesting orders that have been placed include one for nine 333-kva., 12,000-volt power transformers, one for 50 10-kva., 50 25-kva., 50 50-kva., 25 75-kva. pole type distribution transformers, 500,000 lb. of triple-braid weatherproof wire and cables and "Mazda" lamps valued at $150,000. Jobbers' sales are normal. There has been a brisk demand for electric fans, one jobber placing a single order for fans valued at $55,000. Construction projects are as follows:

The Champion Porcelain Company, Detroit, plans an addition to cost $75,000. The Commonwealth Brass Company, Detroit, will build an addition to cost $65,000. The Chevrolet Motor Company, Detroit, will build an addition to its plant at Flint, Mich., to cost $450,000. The Automotive Fan & Bearing Company, Jackson, Mich., plans a plant to cost $150,000. The Hayes Wheel Company, Jackson, Mich., will build an addition to its plant at Chatham, Ont., Can., to cost $500,000. The Olds Motor Works, Lansing, Mich., will build an addition to cost $400,000. The Great Lakes Aircraft Corporation, Cleveland, will establish an airplane manufacturing plant at Marysville, Mich., to cost $200,000. The Michigan Central Refining Company, Muskegon, Mich., a subsidiary of the Amarillo Producers & Refiners Corporation, Amarillo, Tex., will build an oil refinery at Muskegon to cost $90,000. The Muskegon Motor Specialties Company, Muskegon, Mich., plans an addition to cost $100,000. The Commonwealth Edison Company, Chicago, plans a transmission terminal to cost $25,000. Gane Brothers & Lane, Inc., Chicago, plan a bookbinding plant to cost $85,000. The American Encaustic Tile Company, Indianapolis, Ind., plans an addition to cost $100,000. The Warner Gear Company, Muncie, Ind., plans an addition to its automotive gear plant to cost $125,000. The B. F. Goodrich Company, Akron, Ohio, will build an addition to its rubber mill to cost $500,000. The Buckeye Ribbon & Carbon Company, Cleveland, plans an addition to cost $60,000. The Willys-Overland Company, Toledo, Ohio, plans a branch automobile assembling plant at Antwerp, Belgium, to cost $500,000. The Hazel-Atlas Glass Company, Zanesville, Ohio, will build an addition to cost $100,000. The Otter Tail Power Company, Fergus Falls, Minn., plans extensions in the street-lighting system at Voltaire, N. D. Dubuque, Iowa, will install an ornamental lighting system.

More Activity in All Metals, at Firm Prices

More copper, lead, zinc and tin has been sold since June 5 than for many weeks. This is not to say that a buying wave of any great magnitude is on, for business has been meager for some time, but it does indicate that consumers' stocks have reached the point where additional supplies must be ordered for early use.

Most of this metal has been for prompt shipment and at unchanged prices, though tin has advanced about a cent a pound.

NEW YORK METAL MARKET PRICES

	June 5, 1929 Cents per Pound	June 12, 1929 Cents per Pound
Copper, electrolytic	18	18
Lead, Am. S. & R. price	7.00	7.00
Antimony	8.875	8.875
Nickel, ingot	35	35
Zinc, spot	7.05	6.988
Tin, Straits	43.50	44.125
Aluminum, 99 per cent.	24.30	24.30

Base copper wire price June 12, 1929, 19¼ cents.

Activities of the Trade

Texas Creosoting Buys Houston Wood Preserving

The Texas Creosoting Company, Orange, Tex., announces the purchase of the plant of the Houston Wood Preserving Company of Houston, Tex. The Houston company has a modern creosoting plant, covering some 40 acres, and for a number of years has been serving many of the largest users of creosoted products. According to R. S. Manley, president of the Texas Creosoting Company, his organization will operate the newly acquired unit at Houston with the end of bettering the service now being offered users of creosoted materials in all fields.

THE GRINNELL WASHING MACHINE CORPORATION, Grinnell, Iowa, has been reorganized under the laws of the state of Delaware. Its capitalization is now $400,000. Charles G. Adsit has been elected president and I. N. Merritt is vice-president and general manager. The company is now manufacturing and selling two low-priced washing machines of the submerged agitator type and it plans to place on the market a complete line of electrical household appliances by the end of the present year.

THE AMERICAN METALLURGICAL CORPORATION, Boston, manufacturer of electric furnaces, has changed its name to the American Electric Furnace Company.

THE WESTINGHOUSE LAMP COMPANY, 150 Broadway, New York City, announces that it will add the 15-watt, 110-, 115-, 120-volt, A-17 bulb "Mazda" lamp to the sizes that have been previously supplied with inside coloring. The 15-watt inside-colored lamps are now available in standard voltages, in all standard colors, including ivory and old rose, and the 10-watt, 3¼ bulb sign lamp, already available in standard colors and in ivory and old rose, is now available in inside white. These lamps will be supplied at the same prices as apply to corresponding wattages and colors of the inside coated lamp.

JULIUS ANDRAE & SONS COMPANY, Milwaukee, jobber, announces the opening of a branch and warehouse at 1022 East Washington Avenue, Madison, Wis., in charge of A. J. Schaub.

THE APPLETON ELECTRIC COMPANY, 1701 Wellington Avenue, Chicago, manufacturer of Appleton "No-Thread" malleable unilets, announces the purchase of the Gem powerlet line of conduit fittings from the Jefferson Electric Company of Chicago.

N.E.M.A. Adds Eleven New Sections

Fifteen manufacturing companies have joined the National Electrical Manufacturers' Association, 420 Lexington Avenue, New York City, and are affiliated in eleven sections, according to an announcement from N.E.M.A. headquarters.

The manufacturers and their section affiliations are as follows:

Wire and Cable Section: Gavitt Manufacturing Company, Brookfield, Mass.; Globe Insulated Wire Company, Wollaston, Mass.

Carbon Arc Lamp Section: A. S. Aloe Company, St. Louis; Hibner Electric Company, Cleveland, Ohio.

Switchgear Section: Line Material Company, South Milwaukee, Wis.

Molded Insulation Section: Mack Molding Company, Little Falls, N. J.; Recto Manufacturing Company, Cincinnati, Ohio; Union Insulating Company, Parkersburg, W. Va.

Lamp Receptacle and Socket Section: John I. Paulding, Inc., New Bedford, Mass.

Electric Measuring Instrument Section: Standard Transformer Company, Warren, Ohio.

Laminated Phenolic Products Section: Synthane Corporation, Oaks, Pa.

Rigid Conduit Section: Walker Brothers, Philadelphia.

Carbon Section: Pure Carbon Company, Wellsville, N. Y.

Electric Range and Heating Section: Automatic Electric Heater Company, Philadelphia.

High Voltage Insulator Section: Porcelain Insulator Corporation, Lima, N. Y.

Rockwell Company Builds New Plant

The Stanley P. Rockwell Company, 66 Trumbull Street, Hartford, Conn., announces that on August 1 it will be located in a new building at 296 Homestead Avenue, Hartford, where commercial heat treating by both electric and gas furnaces will be done upon dies, tools, bars, forgings, high-speed steel, castings, aluminum and brass. This organization acts as consultant on heat-treating practice and hardening plant control, manufactures the Rockwell dilatometer and is industrial sales representative for the American Gas Furnace Company, General Electric Company, Rodman Chemical Company, Spencer Turbine Company and Wilson-Maeulen Company, Inc.

THE FUSION WELDING CORPORATION, 103d Street and Torrence Avenue, Chicago, manufacturer of welding equipment and supplies, announces the appointment of F. O. Weber, 229 Boulevard Des Allies, Pittsburgh, as sales manager for the company's Pittsburgh district.

THE LEONARD REFRIGERATOR COMPANY, Grand Rapids, Mich., announces that Holt Hollinger has been appointed manager of advertising and sales promotion of its company. Mr. Hollinger for the past five years has been with the Battle Creek Food Company, where he had charge of the advertising and sales promotion.

THE WARD MOTOR VEHICLE COMPANY, Mount Vernon, N. Y., announces that John C. Clendenin, formerly associated with the automotive engineering department of the General Electric Company, has accepted a position as sales engineer with its company.

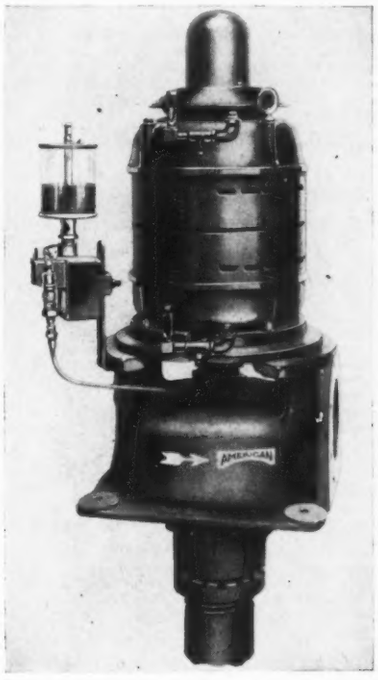
THE WAGNER ELECTRIC CORPORATION, St. Louis, announces the appointment of L. G. Tandberg as branch manager of its Los Angeles sales office, located at 1220 South Hope Street.

THE W. N. MATTHEWS CORPORATION, St. Louis, manufacturer of electrical specialties and mechanical painting specialties, announces that Thomas C. Clark has been made sales manager of its company. Mr. Clark was formerly district manager of the company's St. Louis territory, comprising the states of Missouri, Kansas, Oklahoma and Arkansas, western Tennessee, western Kentucky and southern Illinois. The western Kentucky territory has been turned over to John L. Reighart, 88 Kenyon Building, Louisville, Ky. The company also announces that the E. S. Stickle Company, 934 Union Trust Building, Pittsburgh, has taken over all the state of Ohio formerly covered by B. F. Perry and John L. Reighart. This is in addition to western Pennsylvania and West Virginia, in which states they now represent the W. N. Matthews Corporation.

New Equipment Available

Turbine for Small Bore Wells

A new line of 6-in. and 8-in. deep well turbines to fit smaller bored wells is announced by the American Well Works, Inc., Aurora, Ill. The deep well turbine consists of the turbine head proper, which is the driving unit; the supporting pipe, which incloses the driving shaft, and the turbine itself, which consists of the number of stages necessary for the specific requirements.



The turbine head consists of the vertical motor mounted on a very rigid and compact base. The thrust bearing of the motor is designed to carry the load of the line shaft and impellers. To the turbine head is attached a supporting pipe, to the lower end of which is attached the turbine proper.

The turbine proper is a special style of turbine type of centrifugal. All bearings are oil lubricated by gravity feed from the surface. The gravity feed is electrically controlled. Provision is made for complete drainage of all waste oil and water leakage and the discharge pipe is located above the floor level, which permits of easy access.

DURATACH FIXTURES, a modern construction which, it is claimed, allows new ease of installation, greater interchangeability of lighting equipment and a material reduction in maintenance cost, is announced by the Wheeler Reflector Company of Boston. Duratach construction consists of a socket base attached to a canopy by two screws which fit into bayonet holes in the socket base. The socket shell is attached to the Duratach socket by contacts which extend from the top of the socket shell and are engaged in recesses in the socket base. The socket shell is permanently supported in the reflector neck by means of a metal disk which rides on the metal shoulder incorporated in the reflector neck construction. This arrangement permits the socket shell to revolve with the reflector as it is screwed in or out of the canopy.

Glowtector Indicates Presence of High Voltage

An instrument designed to indicate the presence of high voltages, thus preventing accidents resulting from contacts with high-voltage lines, is announced by the W. S. Wilson Corporation, New York City, under the trade name of the "Glowtector."

The "Glowtector" has an indicator which is a rare gas tube of entirely new design fitted in the bakelite assembly. When the assembly is applied to a live line or bus the tube glows, indicating high voltage. A hood shields the tube from outside light and permits its use in brightly lighted rooms or even intense sunlight. A 3-ft. extension stick of high dielectric strength may be attached to the head assembly. This allows the operator to stand at a distance from the line under test or permits him to reach out-of-the-way lines.

The "Glowtector" with extension stick measures 4 ft. and weighs 2½ lb. It is portable and can be easily carried to any part of the system.

Mine Switching Equipment Occupies Small Space

A new design of automatic switching equipment for synchronous motor-generator sets in mining service is announced by the General Electric Company and was exhibited at the exposition of the American Mining Congress in Cincinnati, May 13-17. This equipment retains the advantages, it is stated, of the older forms and includes several new features.

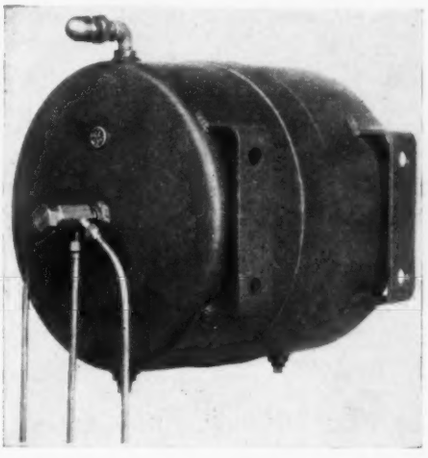
The design is for use with motor-generator sets rated 50 to 300 kw., 2,300 volts alternating current and 275 volts direct current, the standard mine voltages. Like older forms, it automatically controls the starting and stopping sequence for the machine and at the same time affords full protection for the machine and equipment while starting and during operation. A stub-multiple reclosing feeder connects the generator to its load and protects the machine against abnormal direct-current overloads.

The principal features are the use of a new starting and running contactor and the compact arrangement of the high-tension switching equipment.

Pressure Tight Oil Reservoir for High-Tension Cable

A new oil pressure reservoir which takes care of expansion and subtraction of oil resulting from cyclic change in load and seasonal temperature, the principal causes of voids in insulated cables, has been announced by the General Electric Company.

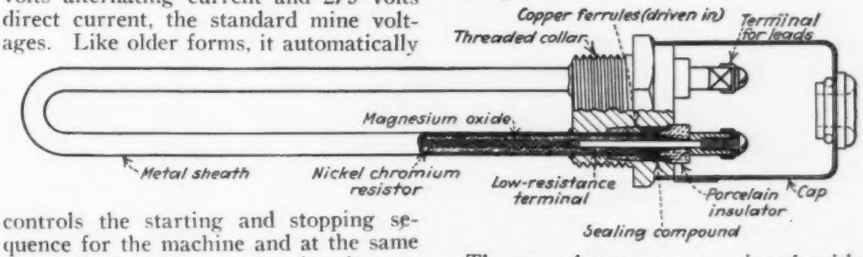
The tank of galvanized metal contains tight gas-filled metallic cells with flexible corrugated walls. When the cable is heated the oil in the cable expands and is forced into the reservoir. The oil contracts when the cable cools and the oil in the reservoir is forced out into the cable by the pressure built up during the heating cycle. The reservoir thus keeps the oil in the system under pressure at all times.



The design of the reservoir is such that the oil is never in contact with the air and cannot absorb gas or moisture.

Heaters Have Perfected Terminals

An important improvement in the design of its electric immersion type heaters is announced by the General Electric Company. This improvement consists of the new method of protecting the terminals.



The new heaters are equipped with sealed terminals and porcelain insulating bushings. The sealed terminals make the unit practically impervious to injury from moisture in the air, splashing liquids, etc., it is claimed.

Electrical Patents

Announced by U. S. Patent Office

(Issued June 4, 1929)

1,715,357. ELECTROPLATING MACHINE; W. F. Hall, Matawan, N. J. App. filed Aug. 19, 1926.

1,715,366. ELECTRIC PLUG; S. W. Hyatt, Connersville, Ind. App. filed Feb. 7, 1927.

1,715,376. ELECTRODE INSTALLATION FOR ELECTRIC FURNACES; J. E. McLaughlin, Berlin, N. H. App. filed April 29, 1925.

1,715,377. MOTOR CONTROLLER; N. L. Mortensen, Milwaukee, Wis. App. filed July 27, 1925.

1,715,395. SOUND-RECEIVING DEVICE FOR SUBMARINE SIGNALING; W. L. Walker, New York, N. Y. App. filed April 25, 1925.

1,715,396. RHEOSTAT FIXTURE FOR ELECTRIC LIGHTS; C. L. Weichelt and H. F. Gill, Philadelphia, Pa. App. filed Nov. 12, 1926.

1,715,411. ELECTROPLATING RACK; N. P. DiCesare, Sheboygan, Wis. App. filed Aug. 22, 1927.

1,715,422. ELECTRICAL SWITCH; W. A. Moritz, New York, N. Y. App. filed Nov. 25, 1924.

1,715,437. FUSE MOUNTING; C. H. Thomas, Chicago, Ill. App. filed June 25, 1927.

1,715,444. VESSEL FOR HEATING PURPOSES; T. Bader, Waldshut, Germany. App. filed July 2, 1926.

1,715,446. ELECTRICAL MEASURING APPARATUS; P. N. Bossart, Swissvale, Pa. App. filed June 18, 1925.

1,715,460. CURRENT COLLECTOR; E. A. Larsson, Mansfield, Ohio. App. filed June 4, 1927.

1,715,464. THERMOSTATIC CONTROL; W. W. McLaren, Birmingham, Ala. App. filed May 9, 1927.

1,715,474. ELECTRIC DISTRIBUTING DEVICE FOR FLOORS; W. B. Sherman, Boston, Mass. App. filed Jan. 2, 1924.

1,715,475. ELECTRICAL PROTECTIVE SYSTEM; R. A. Shetzline, New York, N. Y. App. filed Dec. 29, 1924.

1,715,476. CIRCUIT CONTROLLER; W. E. Smith, Pittsburgh, Pa. App. filed July 12, 1926.

1,715,478. CAP FOR INSULATORS; A. G. Steinmayer, Milwaukee, Wis. App. filed Jan. 5, 1927.

1,715,484. MAGNETIC RECIPROCATING DEVICE; W. Werner, Mexia, Tex. App. filed Aug. 14, 1926.

1,715,499. LIQUID-LEVEL SIGNAL; M. Haines, Mayfield, N. Y. App. filed July 28, 1925.

1,715,507. INSULATOR MOUNTING; W. D. Kyle, Milwaukee, Wis. App. filed July 10, 1925.

1,715,511. INDICATING OR RECORDING APPARATUS; F. S. Potter, Linden, N. J. App. filed March 18, 1921.

1,715,512. HEATING APPARATUS; R. Rochester, Jr., Chicago, Ill. App. filed June 24, 1926.

1,715,518. ELECTRIC HEATER; G. V. Schmidt, Oakland, Calif. App. filed Nov. 2, 1925.

1,715,519. ANNUNCIATOR; L. Scriven, Brooklyn, N. Y. App. filed Feb. 21, 1924.

1,715,520. ELECTRIC HEATER; L. Shuman, Spokane, Wash. App. filed Jan. 29, 1926.

1,715,560. ELECTRICAL CONDENSER; L. E. Menut, Mt. Vernon, N. Y. App. filed Feb. 26, 1926.

1,715,566. ELECTRIC IGNITION APPARATUS FOR INTERNAL-COMBUSTION ENGINES; F. C. Perrem, Leeds, England. App. filed Feb. 10, 1927.

1,715,580. INCANDESCENT LAMP; S. Turner, Salem, Mass. App. filed Feb. 18, 1928.

1,715,592. APPARATUS FOR SEALING CREVICES IN ROCK FORMATIONS OR THE LIKE; G. W. Christians, Chattanooga, Tenn. App. filed Sept. 11, 1926.

1,715,624. SELF-LOCKING TERMINAL CONNECTION; A. C. Reisz, Baraboo, Wis. App. filed Aug. 1, 1923.

1,715,646, 1,715,647, 1,715,648. MAGNETIC MATERIAL AND APPLIANCE; G. W. Elmen, Leonia, N. J. Apps. filed June 30, 1926, and June 28, 1928.

1,715,663. MOTOR-CONTROL SYSTEM; B. E. Lenehan, Wilkinsburg, Pa. App. filed Nov. 2, 1927.

1,715,666. SUPERVISORY CONTROL SYSTEM; J. L. McCoy, Wilkinsburg, Pa. App. filed March 1, 1924.

1,715,676. THERMOSTAT ELECTRIC CONTROL DEVICE; H. E. Rider, New York, N. Y. App. filed March 7, 1928.

1,715,678. MELTING FURNACE; S. Schneider, Meissen, Germany. App. filed Sept. 13, 1926.

1,715,679. PROTECTIVE SYSTEM FOR TRANSMISSION LINES; J. Sessinghaus, Berlin-Charlottenburg, Germany. App. filed March 27, 1925.

1,715,681. CIRCUIT-INTERRUPTING DEVICE; J. Slepian, Swissvale, Pa. App. filed July 19, 1920.

1,715,684. PROTECTIVE SYSTEM; P. Thomas, Edgewood, Pa. App. filed May 3, 1928.

1,715,687. THERMOSTATICALLY-CONTROLLED FLUID HEATER; V. G. Vaughan, Mansfield, Ohio. App. filed Oct. 20, 1927.

1,715,689. ELECTRIC PANEL BOARD; W. Wurdack, St. Louis, Mo. App. filed Nov. 23, 1925.

1,715,690. ELECTRIC-RANGE HEATING UNIT; H. A. Ziola, Toledo, Ohio. App. filed March 11, 1927.

1,715,691. UNIDIRECTIONAL CURRENT-CARRYING DEVICE; D. G. Ackerly, Wilkinsburg, Pa. App. filed Feb. 11, 1925.

1,715,692. HEATER UNIT; C. B. Backer, Brooklyn, N. Y. App. filed Oct. 20, 1927.

1,715,699. DEVICE FOR PROTECTING THE WORKING OF THREE-PHASE MOTORS; G. Ficken, Hamburg, Germany. App. filed Feb. 27, 1925.

1,715,708. CIRCUIT-INTERRUPTER TRIPPING SYSTEM; G. F. Jones, Irwin, Pa. App. filed April 12, 1926.

1,715,713. TREATMENT OF MAGNETIC MATERIALS; V. E. Legg, East Orange, N. J., App. filed Sept. 1, 1928.

1,715,716. SWITCH MECHANISM; A. Müller, Berlin, Germany. App. filed July 27, 1927.

1,715,728. REMOTE METERING SYSTEM; G. G. Waite, Wilkinsburg, Pa. App. filed July 15, 1927.

1,715,761. VARIABLE RESISTANCE AND SYSTEM CONTROLLED THEREBY; J. H. Juers, New York, N. Y. App. filed Jan. 3, 1925.

1,715,769. CANOPY LIGHTING FIXTURE; C. G. Lohman, St. Louis, Mo. App. filed July 15, 1925.

1,715,783. PRODUCTION OF LIGHT BY ELECTRICITY; E. Podszus, Friedrichshagen Berlin, Germany. App. filed Sept. 2, 1921.

1,715,789. ELECTRICAL CONDENSER; S. Ruben, New York, N. Y. App. filed Oct. 10, 1924.

1,715,794. MACHINE FOR MAKING WELDED REINFORCING FABRICS; W. H. Sommer, Peoria, Ill. App. filed June 30, 1927.

1,715,799. FUSE BLOCK AND LIGHTNING ARRESTER; H. A. Taylor, Wilmington, N. C. App. filed April 13, 1928.

1,715,811. ELECTRIC MOTOR; T. R. Arden, Baldwin, N. Y. App. filed Oct. 17, 1927.

1,715,824. ELECTRICAL RESISTANCE UNIT; W. E. Duersten, Milwaukee, Wis. App. filed Aug. 29, 1924.

1,715,866. ASYNCHRONOUS MACHINE WITH CONDENSERS; E. Rother, Kiel, Germany. App. filed Aug. 14, 1924.

1,715,879. HIGH-RESISTANCE UNIT; G. A. Wells, East Orange, N. J. App. filed Feb. 3, 1928.

1,715,888 and 1,715,889. INSULATOR; A. O. Austin, Barberton, Ohio. Apps. filed Dec. 6, 1920.

1,715,899. ELECTRIC WATER HEATER; F. L. Combs, Wapakoneta, Ohio. App. filed Aug. 1, 1928.

1,715,917. SWITCH ARRANGEMENT; G. H. Hart, West Hartford, Conn. App. filed Aug. 4, 1924.

1,715,946. FLUID METER; E. J. Pell, Chicago, Ill. App. filed April 19, 1926.

1,715,948. ELECTRIC SWITCH; J. L. Reinartz, So. Manchester, Conn. App. filed June 27, 1928.

1,716,017. HANGER FOR ELECTRIC-LIGHTING UNITS; E. C. White, New York, N. Y. App. filed Oct. 14, 1926.

1,716,021. WATER HEATER; O. von Zsolnay, C. Coquelin and W. Schulz, Brooklyn, N. Y. App. filed Oct. 25, 1927.

1,716,041. SAFETY SWITCH PLUG; J. Goergl, Chicago, Ill. App. filed July 30, 1926.

1,716,057. TROLLEY DEVICE; H. Holland, Cleveland, Ohio. App. filed Aug. 1, 1927.

1,716,091. DISTORTION MOTOR; M. A. Schwartz, Los Angeles, Calif. App. filed Jan. 11, 1928.

1,716,096. GLARE SHIELD FOR ELECTRIC WELDING; R. B. Weeks, Cleveland, Ohio. App. filed May 18, 1927.

1,716,119. MAKE-AND-BREAK DEVICE; E. C. Fichtner, San Francisco, and J. H. Simon, Oakland, Calif. App. filed Aug. 27, 1926.

1,716,123. INSULATOR; W. T. Goddard, Hamilton, Ont., Can. App. filed July 18, 1925.

1,716,144. TERMINAL DEVICE; M. Morrison, Chicago, Ill. App. filed Sept. 13, 1923.

1,716,155. VACUUM-RESPONSIVE GLOW-TUBE CONTROL FOR RECTIFIERS; L. Smede, Pittsburgh, Pa. App. filed Aug. 6, 1927.

1,716,161. VARIABLE-CAPACITY ELEMENT; C. T. Allcutt, Pittsburgh, Pa. App. filed Sept. 1, 1921.

1,716,164. ACCELERATING DEVICE; E. M. Claytor, Wilkinsburg, and C. H. Hodkins, Pittsburgh, Pa. App. filed June 25, 1927.

1,716,166. DISCONNECTING SWITCH; O. H. Eschholz, Pittsburgh, Pa. App. filed May 12, 1927.

New Trade Literature

RELAYS, RESISTORS, SWITCHING EQUIPMENT, ETC.—The General Electric Company, Schenectady, N. Y., is distributing the following bulletins: GEA-42A, covering its types IK-104 and IK-106 induction power-directional relays; GEA-138A, describing its type FR-1 current-limiting resistor and type LA-1 current-limiting resistor-disconnecting switch; GEA-163B, covering automatic switching equipment, showing the device numbers and their function; GEA-214-A, describing the G-E helicoil sheath-wire immersion heaters for heating water, oil and various other liquids; GEA-334A, describing its gearless traction elevator motors with variable-voltage control; GEA-881B, covering its type WD-200A Continental gas-engine-driven arc welder; GEA-912A, covering its ignition and control transformers for oil burners; GEA-940A, describing its switchboard panel and benchboard pipe fittings; GEA-994A, describing its travel carriage for automatic arc welders; GEA-1021A, describing its type FK-33 oil circuit breakers; GEA-1066A, covering its centrifugal air compressors for sewage-disposal systems; GEA-1096, covering its type LG-18-B indoor disconnecting switches; GEA-1109, describing its type SW-6 form C automatic sectionalizing switches; GEA-1118, describing its types CP, CPQ and CPT-26 two-stage reciprocating air compressors, suitable for railway and industrial service; GEA-1119 and GEA-1120, describing its stationary single-stage and two-stage reciprocating air compressor sets, and GEA-1029A, containing a concise compilation of information as to group-operated rotating-insulator disconnecting switches.

SWITCHES.—Bulletins No. 503 and 504 issued by the W. N. Matthews Corporation, 3722 Forest Park Boulevard, St. Louis, contain data on the latest improvements and additions to the line of Matthews "Fuswitches" and disconnecting switches housed in tidewater cypress, and the open type Matthews "Fuswitches" and disconnecting switches.

LIGHTNING ARRESTERS.—Booklet No. 269 issued by the Electric Service Supplies Company, Seventeenth and Cambria Streets, Philadelphia, entitled "No Deterioration," is the seventh of a series describing the technical features of the crystal valve lightning arrester.

GEARS AND PINIONS.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., has issued catalog No. C-1579-F covering "micarta" silent gears and pinions. The catalog gives an account of the Westinghouse "micarta" gear material; its history as well as the design, application and distinctive features of "micarta" gears. Descriptions and illustrations of the various types of installations of the gears also are included.

RESISTORS.—Catalog No. 429 issued by Hardwick, Hindle, Inc., Newark, N. J., describes and illustrates its resistors and terminals and contains complete data on sizes, ratings and methods of mounting its vitreous enamel coated resistance units.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number:

An agency is desired in Madrid, Spain (No. 38,930), for storage batteries.

Purchase and agency are desired in Durazno, Uruguay (No. 38,931), for storage batteries, electric motors and wiring supplies.

Purchase is desired in Vancouver, Canada (No. 38,926), of rubber-covered cable.

Purchase is desired in Regina, Canada (No. 38,927), of household electrical appliances.

An agency is desired in Montreal, Canada (No. 38,896), for electric railway signals and floodlights.

A sole agency is desired in Caracas, Venezuela (No. 38,928), for household and small commercial electrical refrigerators.

An agency is desired in Cardiff, Wales (No. 38,886), for electric warming pads.

Business Facts for Electrical Men

Selected Statistics Presented Graphically for the Use of All Interested in Analyzing the Trend of the Electrical Business

Half the Copper Is Used Electrically

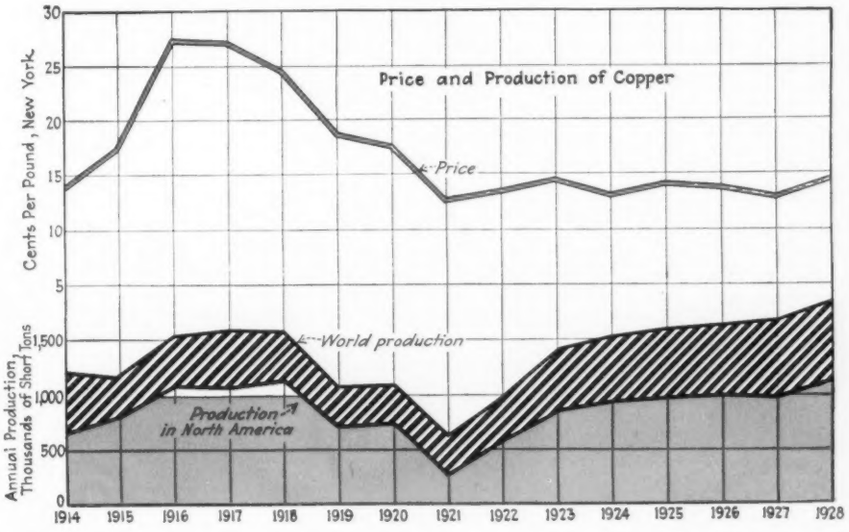
COPPER consumption during 1928 for the major classes of electrical goods exceeded that of any other year since 1919, the first for which segregated data are available, according to estimates published in the 1928 Year Book of the American Bureau of Metal Statistics. Electrical manufactures, including generators, motors, switchboards, lamps, etc., but excluding communication equipment, took 213,000 tons; telephones and telegraphs took 119,000; light and power lines 115,000, while trolley wire is credited with 6,300 tons. The aggregate of these is 453,300 tons. This is 14 per cent greater than the corresponding total for 1927 and 4 per cent over that for 1926, the previous banner year of the decade.

As the table shows, each individual item is larger than in 1927, the first by 8 per cent, the second by 28, the third by 12. The first two are larger also than in 1926 by 6 and 14 per cent respectively. Wire for light and power lines is less by 6 per cent.

Power line construction fell after its maximum in 1926, but rose again in 1928, according to the present figures. The extraordinary rise in this respect since 1920 to an entirely new level is evidence of the enormous demand for construction material during these years of most rapid increase in the number of light and power customers and of far-flung interconnections. In 1920 there were 10,800,000 light and power customers; by the end of 1928 there were 23,400,000. Primary and secondary lines as well as inside wiring had to be expanded accordingly.

As the lower chart indicates, while the total consumption has varied a good deal in recent years the proportions have held fairly constant. Electrical uses again account for slightly less than half the total consumption. For simplicity, several smaller electrical items listed in the Year Book have not been shown. These include an estimated 800 tons for steam railways electrified and 5,100 tons for radio receiving sets.

The upper chart makes evident the large place of North American production in the world's total. The latter for 1928 is given as 1,846,650 short tons; North America's share was 1,080,799 short tons.



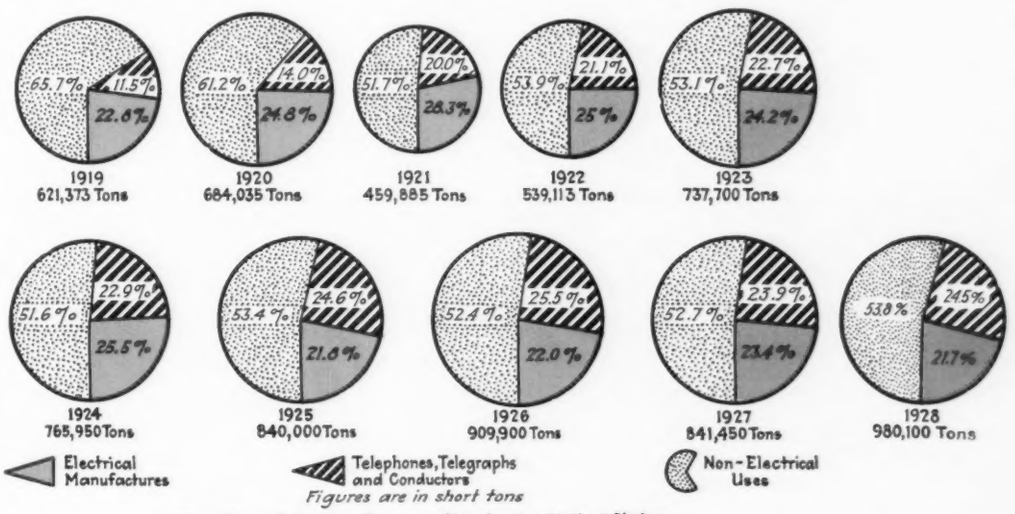
Major Part of World's Copper Comes from North America

*Estimated Consumption of Copper in the United States**

(In tons of 2,000 lb.)

Year	Electrical Manufactures (a)	Telephones and Telegraphs	Light and Power Lines	Trolley Wire
1920	170,000	61,000	29,500	5,400
1921	130,000	54,000	33,000	5,200
1922	134,500	60,000	48,750	4,600
1923	178,500	75,000	85,850	6,250
1924	195,500	80,000	90,000	5,100
1925	183,500	90,000	110,000	6,650
1926	201,000	104,000	122,000	7,000
1927	196,500	93,000	103,000	5,300
1928	213,000	119,000	115,000	6,300

*Year Book, American Bureau of Metal Statistics.
(a) Generators, motors, switchboards, lamps, etc., but exclusive of manufactures for telephone and telegraph purposes.



Allocation of Copper Consumption in the United States

Electrical Machinery Manufacture Takes a Quarter of Our Consumption

Record Industrial Operations in North Central States

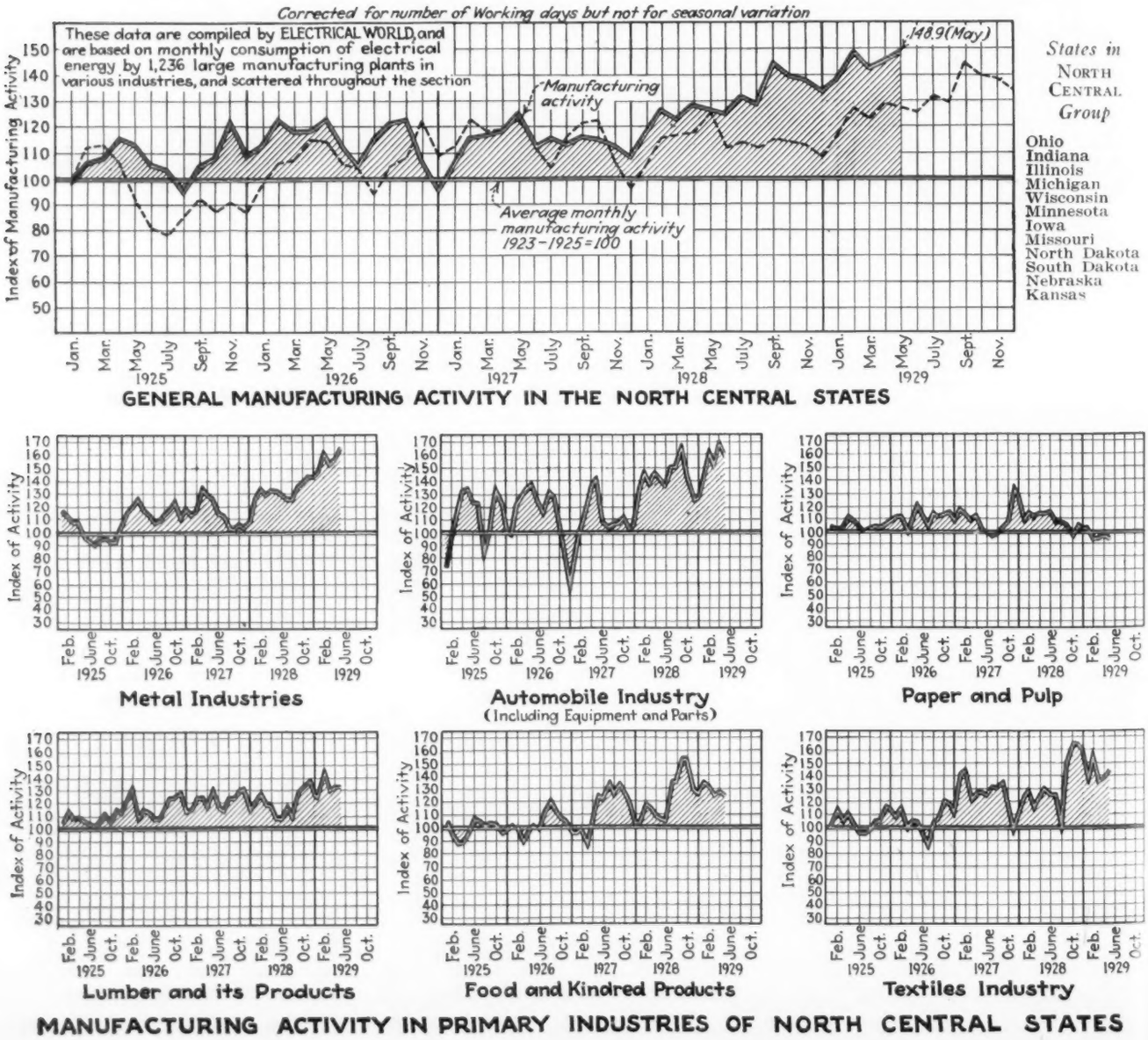
MAY witnessed a new record for manufacturing operations in the North Central States for this season of the year. The seasonably corrected figure for May was 11.7 per cent over the former record figure recorded in October last year. The actual rate of activity in the section, however, before adjustments are made for seasonal variation, was 1.6 per cent above April and 17.1 per cent over May last year. For the first five months of the current year the rate of operations in these plants was 16.5 per cent above that of the same period last year.

The continued high rate of manufacturing activity in the North Central States is due very largely to the record productivity of the iron and steel plants and the very high production in the automobile manufacturing industry. May operations in the rolling mills and steel plants of the section were 17.2 per cent over April and 13.5 per cent over May last year. A slight drop in operations was recorded by these plants during April, but the May operations far exceeded any previous figure.

It appears, however, that the automobile plants reached their peak of activity during April. The May rate of operations in these plants, including the manufacture of replacements parts and accessories, was 5.4 per cent under April and 13.0 per cent over May, 1928.

Indexes of Productive Activity in North Central States

All Figures Adjusted for Number of Working Days

	May, 1929	April, 1929	May, 1928	Average for First Five Months, 1929	Average for First Five Months, 1928
All industries	148.9	146.5	127.2	145.1	124.6
Chemical and allied products	154.8	139.9	140.5	142.8	118.9
Textiles	146.3	137.8	131.4	142.8	125.0
Forest products	132.3	131.5	108.2	132.7	119.0
Paper and pulp	95.0	97.5	112.4	96.2	110.9
Automobile, including parts	159.9	168.8	141.6	158.4	142.2
Rolling mills and steel plants	176.8	150.8	130.6	159.8	131.1
Metal working plants	150.4	157.4	130.5	152.4	131.0
Food and kindred products	124.7	127.2	104.5	128.6	110.2
Leather products	102.2	105.5	97.7	99.3	108.1
Rubber products	179.5	168.7	130.8	167.7	136.3
Stone, clay and glass	125.7	143.9	116.8	128.5	103.2

ELECTRICAL WORLD *Barometer of Industrial Activity in the North Central States*